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# PRINCIPLES OF SURGICAL PRACTICE

## ABDOMINAL TRAUMAS

### Panel Discussion

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#### INTRODUCTION

ANY discussion of this subject, abdominal traumas, involves a consideration of many pathological conditions and clinical signs as they concern the various solid and hollow viscera within the abdominal cavity. In these panel discussions it would seem desirable to elicit as comprehensive a general discussion from the audience as possible. Therefore, the presentations of your leaders will be short and informal.

It would seem wise, because of the numerous organs that may be involved in this broad problem, to consider the subject of abdominal traumas as an entity. There are some phases in the diagnosis and treatment of conditions arising from trauma to the abdomen that are more or less standardized and generally accepted. It may serve a greater purpose to confine a good deal of our thought to the questions that are controversial and less understood regarding the pathology, diagnosis, and treatment of the entity.

Abdominal traumas come under two general heads—the penetrating direct injuries, and the non-penetrating or indirect injuries. The penetrating wounds are due in a vast majority of cases to gunshot wounds and stab wounds. The evolution of the automobile and the ever-increasing number and speed of cars has resulted in all of our seeing more non-penetrating injuries to the abdomen. The mechanism of injuries to abdominal organs from penetrating wounds is easily understood. The larger number of extensive non-penetrating injuries to the hollow and solid viscera are probably caused by a crushing force which results in an impingement of the organ against the spine. Increased abdominal pressure is a factor in producing a bursting force. The distended organ is more susceptible to rupture.

When the patient is first seen following a serious abdominal trauma there is usually severe shock with all of the usual manifestations. Haste in applying surgical therapy should never be employed. The first procedure should be the giving of morphia and atropine. Frequent blood-pressure readings are all important and operative procedures should be delayed until the pressure is above 90, unless there are extenuating circumstances which demand immediate surgical therapy. The intravenous administration of large quantities of salt solution should be avoided until hemorrhage is controlled. The reasons are obvious. The practice of rushing a patient to the X-ray Department should be discouraged. Reasonable roentgenological examinations should always be employed in searching for evidence of free gas in the peritoneal cavity. Since there is serious shock in practically all severe abdominal injuries it follows that our present knowledge of blood transfusion prompts us to use it at once. From 300 to 500 c.cm. should be given, and more as soon as the hemorrhage has been controlled.

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The question of a progressive hemorrhage is the all important one to be solved in determining the advisability of an immediate operation. We are all familiar with the changing blood picture and the relative information frequent blood examinations give us. A more recent method of estimating the amount of blood that is being lost by continuing hemorrhage is by means of the relative specific gravity of the blood as it is recorded at frequent intervals. This test has been made more simple, and Dr. Bailey and Dr. Scudder have presented some excellent observations in this particular. The question of when and if to operate in these serious abdominal traumas places a grave responsibility on the surgeon. In any assessment of the clinical findings in a given case the experience and surgical judgment of the surgeon are paramount in determining the safety and indication for an operation. All penetrating traumas should be operated on as soon as possible. The question of operation in non-penetrating traumas demands careful consideration. The kind and position of the incision employed may be indicated by the position and direction of the wound when present. If there is a wound of entrance and exit, they may be helpful in indicating the organs that may be injured.

Upon opening the abdomen in case of gunshot wounds a systematic search for penetration of the viscera should be made. This may be modified if the wound of entrance and exit indicates that the upper or lower abdominal organs have probably escaped.

If there are several wounds of entrance or external wounds which would seem to show that the missile had traveled the cavity in a longitudinal direction, it is expedient to begin a search in the upper abdomen and expose both surfaces of the stomach; examine the pancreas, liver, and spleen; and then quickly run the intestinal tract from the duodenum to the rectum.

If a penetrating wound of the ascending or descending colon is found which penetrates its posterior attachment and one is working through a longitudinal incision it is good practice to quickly make a transverse cut and expose the retroperitoneal space and later drain this area. The kind of suture material used in closing the perforations will depend on the preference of the operator.

A special word may be said of an injury to the pancreas which may be slight and produce a so-called pseudopancreatic cyst, a collection of fluid in the lesser peritoneal cavity. This will manifest itself later.

Drainage of the peritoneal cavity after repair of the damage is not satisfactory and should not be employed unless packing for hemorrhage or for drainage of a penetration into the retroperitoneal space has been done, or when the urinary bladder is involved. The after-treatment is that employed in any serious abdominal operation and may require blood transfusions and maintenance of the water balance. The value of the Wangensteen tube in the after-treatment in such cases is well recognized.

## CAUSE OF THE MORTALITY

JOHN H. MULHOLLAND, M.D., F.A.C.S., New York, New York

A DISCUSSION of the general subject of abdominal traumas involves such an extensive consideration of its many aspects that one individual can, with profit, approach but one phase. Because each case is an individual problem, guiding principles applicable to all cases must be based on the broadest surgical experience. The importance of the subject is, of course, attested by the generally reported high mortality figures. An attempt to reduce the mortality by any means available is the direct approach, and almost all advances in surgery will find use in abdominal injuries. A review of 70 cases was made with this in mind. All were from the Third (New York University) Division of Bellevue Hospital and all were abdominal traumas of the penetrating type. The patients were admitted prior to early 1939, when newer methods of diagnosis and care were instituted.

The mortality in this series was 36 cases, or 51 per cent, of which 30 were examined at autopsy. The records of these 30 patients were used for the review which is the basis of this discussion. The records in many cases were not specific enough to attribute death to any one cause. Contributory findings or combinations of the three leading mortality factors—infection, shock, and hemorrhage—were the rule. When one made an attempt to decide which of these three conditions was most prominent and to state one primary cause of

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death on the assumption that if this factor were controlled the death might not have occurred, some interesting findings resulted.

In some cases, infection was obviously the cause of death, no hemorrhage and no record of shock being found. These patients all died after operation and an elapse of time which was greater than the shock and hemorrhage period. Autopsy, as a rule, revealed generalized peritonitis. In other cases, hemorrhage was obviously the cause of death. Large collections of blood in the peritoneum, retroperitoneal tissues, or even in the chest, in patients who succumbed shortly after injury, were the common findings. In a few there was neither hemorrhage which could be considered sufficient in itself to produce death, nor infection. These cases were designated as fatalities due to shock. Hemorrhage and shock combined are so mutually enhancing and fatal that division of responsibility is always difficult. The degree of shock and the mortality rate is in direct proportion to the amount of hemorrhage. Nevertheless, an attempt was made to designate a single condition. On this basis, with one cause only selected as the lethal one or the most important, the cases may be divided as follows:

13 patients or 43 per cent died of infection
13 patients or 43 per cent died of shock (?)
4 patients or 14 per cent died of hemorrhage

An analysis of all the cases was made with the following questions in mind: Could any have been saved? Are there any new concepts which, applied to these patients, would have aided in the diagnosis, preparation, or treatment? Could these methods be carried out speedily, easily, and by the average surgeon? It would appear that all these questions may be answered in the affirmative.

There were 4 cases with profuse hemorrhage. Two of these were not operated upon because of the poor condition of the patients on admission. One was a stab wound with laceration of the mesentery and bleeding from the mesenteric vessels. This patient lived for three hours and did not respond to measures designed to combat shock. The other non-operated case was that of a patient with a stab wound of the lower abdomen who was admitted in poor condition; he did not respond to the ordinary shock measures and died in forty-eight hours. There were no signs indicating peritoneal irritation. At autopsy a laceration of the external iliac artery with an enormous retroperitoneal hemorrhage was found. One patient was operated upon late; a lacerated spleen was removed, but the patient died. The fourth patient was diagnosed as having a severe hemorrhage; he was operated upon and the bleeding point secured, but he died shortly.

It is conceivable that with different management in the first 3 patients they may have survived. Non-recognition of the fact that hemorrhage was the cause of collapse and that no measure short of controlling the hemorrhage would be of avail resulted in delay.

There were 13 cases in which shock was the principal factor producing death. In many of the patients, multiple injuries of the chest or head were present, which complicated the abdominal trauma. Among this group, however, there were 4 patients who died following early, adequate operation within a short period after operation and with no signs of infection. Two of these patients were diagnosed as having hemorrhage before operation. It seemed that shock was not adequately treated before operation in the other 2 cases.

There were 13 cases of infection. Two had visceral lesions which were missed at operation and discovered at autopsy. Among the remainder, it was difficult to determine whether technical mistakes, e.g., leaking anastomosis, or the initial spilling, was the prime cause of infection. It is reasonable to assume that some infected cases, at least, were due to the initial trauma and, if a method for combating the infection had been at hand, they might have been saved.

If 3 cases of hemorrhage, 2 of shock, and 2 of infection had been saved, our mortality would have been reduced by 10 per cent—from 51 to 41 per cent. It is not unreasonable to expect such a reduction with the newer methods available for diagnosis, preparation, and treatment of these patients. As has been pointed out by Dr. Bailey in this panel and in his writings, we have methods for the differentiation of shock and hemorrhage which are simple and easy to carry out. A repeated determination of the specific gravity of the blood by the falling-drop method is a sensitive and accurate measure of blood loss or blood concentration. Confirmatory hematocrit or plasma-protein determinations are helpful, but a curve of changing specific gravity is the most delicate index of the condition of the patient under the circumstances. If the diagnosis of lacerated external iliac artery had been made early in its course—and specific-gravity determinations every half hour could have established the fact within three hours—a relatively simple ligation would certainly have saved the patient. He survived for forty-eight hours on supportive treatment. In the case of the lacerated spleen, the knowledge of intermittent severe bleeding, which probably

occurred, would have pointed at an early hour to the spleen, and earlier surgery might have saved the patient.

In the matter of infection, there are two measures of recent use which might have helped in this early series. The first is the use of sulfonamide drugs locally in the peritoneal cavity, and orally; the second is the use of the Miller-Abbott tube during the postoperative period in all intestinal operations or in all patients with ileus. The first measure has not been thoroughly evaluated as yet because of an insufficient number of cases, but there is promise of effectiveness from the use made so far. We know that high concentrations at the site of infection, early in the invasive stage, is the ideal method of use. The value of decompression of anastomosed intestine by intubation is well established by numerous reports. The suture line can be maintained without tension in non-distended collapsed bowel. Ileus, even though it be a result of infection, must be relieved if the patient is to gain control of the process.

Our procedure at the present time is therefore:

1. Careful study of all cases in which there is any doubt as to the diagnosis; frequent determinations of whole-blood specific gravity by the falling-drop method beginning at the time of admission.

2. Operation early in cases with a falling specific gravity to stop hemorrhage. Transfusions of whole blood are administered before, during, and after operation.

3. Delay and shock treatment in cases with a rising specific gravity and collapse. Shock treatment is, in brief, the administration of morphine, heat to the periphery, infusions of salt solution, glucose, plasma, or whole blood.

4. Administration of sulfanilamide or one of the sulfonamide drugs intraperitoneally at the time of operation and by mouth or parenterally later, and the maintenance of satisfactory blood levels.

5. Intubation with the Miller-Abbott tube in all cases of intestinal anastomosis, ileus, or suggestive peritonitis.

There are an insufficient number of cases to compare statistics, but indications are that improvement in mortality rates will follow. Certainly, nothing which gives the slightest promise of reducing the mortality should be omitted in the care of these patients with such an appalling death rate. Some cases are obviously hopeless at first sight; others appear to be only slightly affected by the trauma; but all are deserving of every effort and all are serious conditions. When a patient with a penetrating abdominal wound which involves the colon or a large blood vessel (the mortality is highest in this group) recovers, it is a surgical triumph. The technical procedures involved in the treatment may be simple or the most complicated. In any case, every resource of advanced knowledge must be used. There is no field in which the dictum of gentle handling of the tissues to prevent shock is more important. Indeed, no other single surgical condition requires judgment so astute, skill so highly developed, or experience so broad.

## INTRA-ABDOMINAL INJURY

FRED W. BAILEY, M.D., F.A.C.S., St. Louis, Missouri

THERE are two types of intra-abdominal injury:

1. The penetrating type—in this, exploration clarifies the diagnosis and simplifies treatment.

2. The non-penetrating type. This type threatens unpredictable dangers. Its rarity of occurrence should not decrease our zeal and endeavor to diagnose and relieve: but the toll of severe auto injuries from collisions, sudden stops, overturns, and crashes is rapidly increasing in number and severity as speed and traffic increase. Direct trauma to the abdomen, or indirect, such as a sudden fall or an acute jackknife, may result in rupture of the liver, spleen, kidney or pancreas, as well as rupture of a fluid-filled intestine, stomach, bile or urinary bladder, and serious mesentery laceration with fatal hemorrhage. Dangers of such injuries are hemorrhage, shock, and peritonitis. All three may be present, with overlapping symptoms. Deep shock may be continued by progressive hemorrhage, and hemorrhage may be aggravated by ill-advised attempts to treat shock. It is most important to make a prompt definite diagnosis for the following three reasons:

1. Intra-abdominal hemorrhage which is not controlled demands exploration
2. A ruptured viscus demands early operation

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3. Profound shock indicates a shattered autonomic nervous system, and disrupted circulation, and requires not operation but prompt restabilization.

When a viscus has been ruptured, symptoms of peritoneal soiling are unmistakable within a few hours.

Shock and hemorrhage are not so easy to individualize or distinguish by clinical symptoms. Cellular changes of the blood with increase of the white-cell count, decrease of the red-cell count, and fading hemoglobin indicate bleeding. The older method of determining the hemoglobin and red-cell count is inadequate in a case of suspected internal hemorrhage. Therefore, the ingenious and effective falling-drop apparatus, as developed by Barbour and Hamilton, will aid in determining the exact blood changes 25 times more accurately and very quickly, through specific-gravity readings, and thus simplifies our diagnosis and therapy. When the specific gravity of peripheral blood increases, water loss is present. When the specific gravity decreases, hemorrhage is present. With the hematocrit the cell volume, plasma protein, and plasma potassium may be accurately determined, which greatly aids therapeusis.

In cases of intra-abdominal or concealed hemorrhage, instead of a 250,000 alteration in the red cells necessary to register in the blood count, an alteration of 10,000 cells can be demonstrated through specific-gravity readings, and can be made much more frequently; this informs the attendant whether bleeding is progressing, decreasing, or remaining static. This valuable laboratory aid materially reduces the incidence of surgical entry into suspected abdomens and thereby eases the surgeon's responsibility and avoids unwarranted explorations, many of which may re-establish an acute hemorrhage. Three hundred cubic centimeters of 5 per cent saline solution with 20 c. cm. of suprarenal cortical hormone (eschatin) are valuable in combating shock and re-establishing a faltering physiological balance, aided by transfusion of blood or plasma as indicated by specific gravity and hematocrit readings. It is our considered decision that the ruptured spleen or liver that has weathered the primary hemorrhage will not require surgical intervention in the large majority of cases if conservatively but conscientiously treated. However, the unusual case requiring surgery may be accurately gauged by this method and treated accordingly.

## COMPLICATIONS OF ABDOMINAL TRAUMAS

AMBROSE H. STORCK, M.D., F.A.C.S., New Orleans, Louisiana

SINCE this panel discussion, reports concerning abdominal traumas in the present war in Europe have become available. Furthermore, certain recent non-military studies deserve consideration in respect to their applicability in the prophylaxis of war injuries of the abdomen. The significance and implications of these experiences and studies will be briefly reviewed following this discussion.

Abdominal traumas may be considered from the standpoint of the complicating conditions which, if permitted to develop or persist, cause death.

*Hemorrhage and shock.* Except in those cases in which visceral injury or parietal destruction is incompatible with life, hemorrhage and shock are the factors most frequently responsible for death. Early, rapid transportation of abdominal casualty cases in properly heated conveyances can not only prevent the further development of shock, but be effective in combating shock which has already developed. Under some circumstances, transportation by airplane is not only desirable, but feasible. When transportation is effected by railroad, military casualty cases may receive even more active treatment for shock and hemorrhage than is afforded by rest and heat alone. Unnecessary moving of patients on and off of litters, examining tables, x-ray tables, or operating tables increases the amount of shock, and causes unnecessary pain and discomfort.

Pre-operative preparation of the patient in the operating room is often desirable in order to avoid preliminary moving in and out of bed and for the purpose of permitting advantage to be taken of the first period in which improvement from shock will permit operative treatment. In addition to the application of external heat, elevation of the foot of the bed, and the administration of an appropriate amount of morphine, an attempt must be made to restore and maintain the blood volume by the transfusion of fresh whole blood, preserved plasma, or preserved whole blood, although circumstances may demand dependence upon infusions

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of saline and glucose solutions. Studies of the specific gravity of the blood by means of the falling-drop method, and the determination of the mean corpuscular volume, as discussed by the collaborators who have preceded me in this panel discussion, are valuable therapeutic guides in the management both of cases which when first seen definitely manifest shock and hemorrhage, as well as in cases in which the presence or progress of shock and hemorrhage is doubtful. It is now appreciated that the 500 or 1,000 c.cm. transfusions, which formerly were considered adequate, are actually ineffectual and that much larger amounts, i.e., 2,000 or 3,000 c.cm., are often necessary. There are evidences that adrenocortical extract is of value in the treatment of shock, and there have also been observations which suggest that the administration of blood plasma along with pituitary extract is more effective than the administration of plasma alone. Oxygen therapy is of proved value in relieving anoxia associated with shock, whether or not due to hemorrhage, and several types of apparatus are now available which facilitate the easy administration of this gas. Potent preparations of thrombin have been produced which should prove valuable for topical application to bleeding surfaces such as exist following lacerating liver wounds.

*Peritonitis and ileus.* Some degree of these conditions is inevitably associated with most penetrating wounds of the abdomen, and ileus may also follow non-penetrating wounds of the abdomen. The administration of morphine in doses sufficiently large to maintain intestinal tone, the application of heat to the abdomen, and the avoidance of distention of the gastro-intestinal tract by the employment of suction drainage and oxygen therapy are measures of proved value for both the prevention and treatment of peritonitis and ileus. Administration of adrenocortical hormone is a rational means of combating the adrenocortical deficiency associated with peritonitis. Maintenance of the blood-plasma proteins at normal levels by means of transfusions of whole blood, or blood elements, is effective, not only for maintaining liver function and resistance to infection, but for assuring the presence, in adequate amounts, of those elements which are important in the healing of wounds, including wounds in the hollow viscera. The need for, and the method of maintaining water balance and furnishing mineral requirements in cases with peritonitis, requires no further comment. There is evidence which suggests the efficacy of sulfonamide drugs placed directly into the peritoneal cavity as a means of preventing or reducing the severity of peritonitis. The administration of appropriate amounts of vitamins, especially Vitamins B and C, has a definite place in the total treatment of peritonitis. Experimental work is at present under way in the Department of Surgery at Tulane University, which it is hoped will demonstrate the feasibility of reducing the severity of peritonitis in military casualty cases. This investigation concerns the transformation of the intestinal flora of troops on active duty who are likely to sustain abdominal perforating wounds, by the administration of cultures of lactobacilli.

*Wound infection.* This is to be anticipated in most cases of abdominal injury, either from external sources or from the perforation of hollow viscera. In addition to the administration of appropriate antisera, such as tetanus and mixed anti-anaerobic sera; adequate débridement of the wound; the use of non-absorbable suture material, such as silk, cotton, or wire; the instillation of sulfonamide drugs into the wound; the administration of large doses of Vitamin C; the maintenance of plasma protein at levels which permit sound wound healing; and the application of pressure dressings are among the measures which reduce the frequency of serious postoperative wound infection and wound disruption. Drainage of the wound by means of rubber tissue will usually prevent the development of an intramural abscess which could subsequently rupture into the peritoneal cavity. When wound infection develops despite the measures which have been enumerated, adequate drainage of the wound, followed by the application of zinc-peroxide-paste dressings, may be employed especially in those cases in which there is infection with micro-aerophilic hemolytic streptococci or other anaerobic organisms.

*Pulmonary complications.* Atelectasis and pneumonia are frequent complications of abdominal wounds. Associated chest injury, shallow respiration due to pain, limited excursion of the diaphragm due to abdominal distention, and tight abdominal dressings are among the causes of these complications. The administration of morphine in amounts sufficient to relieve pain but not to undesirably depress respiration, frequent changing of the patient's position, deep breathing exercises beginning immediately following operation, avoidance of too-tight abdominal dressings, and aspiration of secretions from the pharynx and trachea following anesthesia are measures which reduce the incidence of pulmonary complications. When atelectasis occurs, bronchoscopic aspiration usually should be done. Modern methods of treating pneumonia with sulfonamide drugs and serum have improved the prognosis in cases in which this complication develops.

*Associated injuries.* Injuries to other parts of the body are responsible for the death of many abdominal casualty cases. Spinal-cord injuries, head injuries, neck injuries, and serious injuries to the extremities, in addition to abdominothoracic wounds, often determine a fatal outcome in individuals who would have survived the abdominal injury.

*Overlooked or unrecognized abdominal injuries.* Failure to promptly recognize the fact that serious abdominal injury has occurred is responsible for a considerable number of deaths. Although failure to realize that serious visceral injury has occurred is most frequent in the instance of nonpenetrating subparietal injuries, failure to consider the possibility of intraperitoneal penetration is not uncommon in the instance of missiles which enter through the hip, gluteal region, perineum, or sacral region.

The symptoms and physical findings associated with intra-abdominal injury are sometimes remarkably ill-defined. Pain may be absent, and even when present may be of such a degree or distribution that it is of little or no value in indicating the location or extent of the injury. Nausea and vomiting may not occur, even when the stomach has been penetrated. Tenderness and rigidity may be either so slight or so indefinitely localized as to be of little or no value in diagnosis. Careful observation of the character of respiration is essential, because in the presence of intra-abdominal injury, there is usually an absence of an abdominal element in respiration. Significant changes in the pulse rate and blood pressure frequently do not occur until extensive hemorrhage has occurred, or until shock is impending or established. The determination of changes in the specific gravity and mean corpuscular volume of the blood is a more dependable method for detecting shock and concealed hemorrhage than is observation of the pulse rate and blood pressure. The newer method should be employed especially in the study and observation of cases in which intra-abdominal injury is suspected, although not definitely known to be present. Red blood-cell counts often do not change significantly until serious hemorrhage has occurred. Study of the entrance and exit wounds, or x-ray localization of a missile which has been retained, usually indicates whether or not there has been intra-abdominal penetration. Peritoneoscopy may be employed under some circumstances, especially for the purpose of revealing penetration of the peritoneum, but this method is not dependable for determining the presence or extent of visceral injury. When considering the possible entry of a missile into the abdominal cavity, it is helpful to know the position or physical attitude of the patient at the time the injury was incurred. Injuries to the kidneys and urinary tract, although often not productive of distinctive symptoms, will usually be revealed if either gross or microscopic examination of the urine is made in all cases in which there is any possibility of their injury.

In addition to complete failure to consider the possibility of abdominal injury, one or more visceral injuries are often overlooked even during operation. Perforations of the posterior wall of the stomach and those near the junction of the mesentery with the intestines, as well as perforations involving the rectum or located in the region of the splenic and hepatic flexures of the colon, may easily be overlooked unless the possibility of injuries in these locations is kept in mind.

*Anesthesia.* The choice of anesthesia may be influenced by the presence of associated thoracic, neck, head, or spine injuries. Gas anesthesia does not, as a rule, permit the degree of abdominal relaxation which facilitates thorough and rapid exploration. Ether, because of its ready availability and the great number of people who can administer it, will, in spite of its undesirable features, continue to be most appropriate in some cases. Spinal anesthesia, although unequivocally condemned by some observers for employment in all cases of gunshot or penetrating wounds of the abdomen, is frequently the anesthetic of choice, and if its use is limited to appropriate cases, it is not only a safe, but a highly desirable form of anesthesia. In 10 of a series of 46 personal cases of penetrating wounds of the abdomen, spinal anesthesia was administered, and in none of these was there a fatal outcome. Local anesthesia is usually inadequate, especially in cases with extensive abdominal trauma, although it may be advantageously used at times to supplement inhalation anesthesia.

*Prolonged, unnecessary, or undesirable operative procedures.* The necessity of expeditiously performing the minimal amount of exploration, and of limiting any operative procedures to the simplest forms which will be adequate is in no type of case more important than in the instance of the patient who has suffered a severe abdominal trauma. Repeated handling and reinspection of the intestine prolongs the operation and the anesthetic, and increases the amount of shock associated with the operative procedure. Enterostomy, which was formerly considered appropriate in many cases, should seldom, if ever, be employed. Resection of segments of intestine should be avoided whenever possible, as the individual repair of even multiple closely situated perforations causes less shock than is produced by the resection of even a small

segment of bowel. When resection of a segment of intestine is imperative, mechanical anastomosis devices should not be used for re-establishing the continuity of the gut.

Lavage of the peritoneal cavity, in order to wash out foreign bodies, is not only ineffectual and almost certain to cause dissemination of infectious material, but it is also undesirable because of the exposure, chilling, and loss of body heat which it entails. It is better to suck out, pick out, or sponge out blood, blood clots, pieces of clothing, pieces of wadding, feces, or other foreign bodies, rather than to attempt to remove them by lavage. Effective drainage of the peritoneal cavity is not only impossible, but the introduction of drains is likely to lead to secondary intestinal obstruction, or to the formation of intestinal fistulas.

*Residual abscesses.* Undrained residual abscesses in the subphrenic space, the cul-de-sac of Douglas, the iliac fossæ, between loops of intestine, or in other areas of the abdomen, may be responsible for a fatal outcome if overlooked. The likelihood of the development of such abscesses must be kept in mind, and frequent examinations made to detect them by physical means or by the aid of x-ray examination.

Reports concerning the high mortality associated with abdominal injuries in the present war in Europe indicate that many of the injuries are of such an extensive and multiple nature that many are either immediately fatal, or make eventual recovery impossible. The speed of modern warfare so complicates and interferes with the collection and transportation of abdominal casualty cases, that it is now more than ever important to consider the possible preliminary precautions which may be taken to reduce the incidence of the wounds, or to minimize their seriousness. Motorized mobile hospital units and transportation of abdominal casualty cases by means of airplanes can, to a limited degree, relieve the present situation. At a meeting of the Section of Surgery of the Royal Academy of Medicine of England in June, 1940, it was stated that at the time the English forces left France, there were probably 2,000 casualty cases in base hospitals in France, of which only about a dozen had chest or abdominal wounds, thus evidencing the early high mortality in such cases. This experience indicates the need for the adoption of some type of protective body armor, such as was employed during the recent successful invasion of Belgium. The recent demonstration of the effectiveness of sulfanilylguanidine administered orally, in greatly reducing the number of coliform bacteria in the intestinal tract, suggests that the preparation of troops who are to go into action by means of appropriate administration of this drug may result in reduction of the virulence of peritonitis caused by penetrating abdominal injuries.

# ABSTRACTS OF CURRENT LITERATURE

## SURGERY OF THE HEAD AND NECK

### EYE

**Kirby, D. B.: Injuries of the Eyes.** *Surg. Clin. North Am.*, 1941, 21: 331.

Kirby takes up the various types of ocular injuries systematically and illustrates many of them well. He gives the complications to be expected, the treatment, and prognosis. The latter part of the paper is devoted to medicolegal problems encountered, the basic factors used in the various states for computing visual disability, and the duties of the physician in testifying at law-suits.

A copy of this paper should be a ready reference for eye physicians. LESLIE L. MCCOY, M.D.

**Caveness, H. L., Satterfield, G. H., and Dann, W. J.: Correlation of the Results of the Biophotometer Test with the Vitamin A Content of Human Blood.** *Arch. Ophth.*, 1941, 25: 827.

In 71 subjects the authors determined the Vitamin A and carotene content of the blood by the method of May with the Evelyn photo-electric microcolorimeter; calculated the total A biological activity of the plasma in USP units; and made biophotometer tests according to Jeans. On the assumption that night blindness is due to Vitamin A deficiency, it might be expected that a single datum for expressing the degree of night blindness would be correlated fairly closely with the Vitamin A content of the blood. However, as a result of their statistical analysis the authors conclude that it would be impossible to make a useful prediction of the Vitamin A content of the blood from the light-adapted or dark-adapted visual thresholds measured by the biophotometer or *vice versa*. Hence, they deduce that the biophotometer is unlikely to prove a suitable instrument for measuring with any precision the degree of Vitamin A undernutrition of the human subject.

In their second article 2 healthy subjects were put on a Vitamin A deficient diet for five weeks. No significant change occurred in the Vitamin A level in the plasma and no change in dark adaptation occurred. This seems to indicate that no deficiency occurred during the period of observation even though the diet was selected to be very low in Vitamin A. They conclude that the whole question of normal Vitamin A nutrition needs re-examination.

PAUL STARR, M.D.

**Kravitz, D., and Moehle, W.: Exophthalmos in Hyperthyroidism.** *Am. J. Ophth.*, 1941, 24: 527.

The authors present a résumé of the literature together with the prevailing theories and views regarding exophthalmos in hyperthyroidism. Several of the case reports are very interesting and instructive. It is concluded that although the exophthalmos in toxic goiter is the result of a general stimulant circulating in the blood, one eye may be involved an appreciable time before the other. This may occur because the sympathetic chain on one side has been sensitized to the toxin earlier.

Of further interest was the early presence of increased intra-ocular tension as soon as conjunctival edema presented itself, and the increase of the tension as the edema of the conjunctiva and the exophthalmos increased. With the increase in tension the cornea became steamy. Thus, the picture of an acute glaucoma was present early in the progress of the disease. It seems to the authors that this complication may be the result of edema of the orbital tissues and interference with the venous return from the eye. This, however, does not explain the corneal ulcer, which came on simultaneously with the lagophthalmos and before increased tension in the eye was manifest; nor can the ulcer be explained by the lagophthalmos, which was not present long enough to result in a drying of the cornea.

It would therefore appear that in certain cases the circulating toxins have a direct deleterious trophic effect upon the cornea. Later, the increased tension and conjunctival edema further interfere with corneal nutrition, with a resultant spread of the ulcer and ultimate destruction of the cornea.

The early orbital congestion and the conjunctival edema are somewhat difficult to explain. Stimulation of the sympathetic nerves should result in contraction of the arteries, and so prevent, or at least have a beneficial effect on, edema; but the rapid occurrence of edema speaks rather for a vascular paralysis, with a rapid transudation or exudation of fluid. The chronic inflammatory changes found in sections of excised conjunctivas are probably the result of a long-standing edema. It may therefore be that one of the circulating toxins has a direct paralyzing effect on the musculature of the blood vessels, or that it acts via the parasympathetic system at the myoneural junction.

In view of the work in endocrinology, the early administration of thyroxin should have been tried.

In addition, x-ray therapy over the pituitary region might be tried. Large doses of phosphorus and calcium to lessen the irritability of the nerves are indicated.

From a survey of the available literature, it would seem that exophthalmos in man is the result of a sympathetic stimulation with a resultant contraction of Mueller's orbital muscle. In addition, there seems to be a vascular paralysis which results in orbital and conjunctival edema. This, together with a direct

trophic effect on the cornea, results in the rapid destruction of the latter.

Because of the various physiological reactions, the underlying anatomical changes in these cases of exophthalmos are different. For this reason no form of therapy, including decapitation of the roof of the orbit, has thus far been successful in more than a small percentage of cases. Possibly, application of the newer ideas in endocrinology may give better results. When other methods are failing they are at least deserving of trial. LESLIE L. MCCOY, M.D.

**Verhoeff, F. H.: Occlusion Hypertropia.** *Arch. Ophth.*, 1941, 25: 780.

Analyzing 42 cases of what has at various times been termed alternating hyperphoria, double hyperphoria, and alternating hypertropia, the author concludes that these terms are inexact and suggests that the condition be called occlusion hypertropia.

By means of numerous tests and on theoretical grounds he states that three conjugate mechanisms can be differentiated, two monocular and one binocular. Occlusion hypertropia may then be considered as due to congenital monocular conjugate insufficiency, either unilateral or bilateral. This conjugate insufficiency may concern the superior oblique muscle, the inferior rectus, or both. There are usually associated motor defects, especially esophoria or esotropia. Nystagmus may be present. There is often a congenital hypoplasia of one or both fourth nuclei, which produces the effect of so-called overaction of the inferior oblique muscles.

The presence of occlusion hypertropia should be considered in planning the treatment of cases of strabismus. WILLIAM A. MANN, M.D.

**Lijó Pavía, J.: The Eyeground Under Sodium Light. Cases of Old Trauma with Loss of Vision in One Eye and Lesions of the Eyeground in the Other** (Fondo de ojo a la luz de sodio. Traumatismo antiguo con pérdida de un ojo y lesiones del fondo en el otro). *Rev. oto-neuro-oftalmol. y de cirug. neurol. sud-americana*, 1941, 16: 41.

Three cases are described in which an old injury had caused loss of vision in one eye and lesions of the eyeground in the other. The first patient was a man of thirty who had been struck in the left eye with a stone when thirteen years of age. The second was a woman of forty-eight who had suffered an injury of the right eye six years before, which had necessitated the enucleation of the eye five years later. The third was a man of forty-seven who at the age of two or three years had been struck in the right eye with a stone and did not remember ever having had vision in this eye. The last 2 patients had signs of syphilis and were given anti-syphilitic treatment. Detailed descriptions of the ophthalmological findings with different forms of light are given and illustrated with stereoretinographic pictures. Sodium light showed perhaps more detail in regard to the condition of the vessels and nerves than ordinary light, and in the second case in which ordinary light showed punctate lesions which could not be definitely localized, sodium light showed that these lesions were localized immediately behind the retina.

AUDREY G. MORGAN, M.D.

## EAR

**Frey, H., Stokes, A. B., and Ewing, I. R.: Discussion on the Psychological Aspects of Deafness.** *Proc. Roy. Soc. Med.*, Lond., 1941, 34: 309.

Frey states that the mental depression of the deafened is open to relief by the application of mental energy, and effort seems to him to be the best proof of its neurotic character and origin. Only a few of the deaf can find their way out of their pathologically strained mental condition unaided. This opens a wide vista for the psychic treatment and re-education of these individuals.

Stokes states that the lessening of the burden of deafness by the use of hearing-aids, by lip reading, and by social readjustments will allow compensations to develop within the personality. An understanding of the kind of person to be dealt with will indicate how the best compensations may be fostered.

Ewing states that the psychological effects of deafness depend upon many other active and reactive factors in addition to deafness itself—the health and age of a patient; his environment and experience; his social attitude and his disposition towards difficulties; his intelligence, and physical and mental readiness or unreadiness to acquire new habits; the nature of his work and interests; his resourcefulness; and his sense of humor. JAMES C. BRASWELL, M.D.

**Lempert, J.: Endaural Fenestration of the Horizontal Semicircular Canal for Otosclerosis. Indications, Technique, and Observations as to Early and Late Postoperative Results.** *Laryngoscope*, 1941, 51: 330.

Lempert states that surgery for the improvement of hearing in otosclerosis is no longer in the experimental stage. There is no surgical risk to life involved in the fenestration of the external semicircular canal for the restoration of practical physiological hearing in otosclerosis when this surgical procedure is performed under the strictest rules of asepsis. The amount and nature of the discomfort a patient is subjected to as a result of this surgery compares favorably with any other elective major surgical procedure and is disproportionately small when compared to the physical, mental, social, and economic benefits derived from such surgery when it results in the restoration of practical hearing.

The success of this work, of course, will always vary with the skill and patience of the operator. Practical physiological hearing can be permanently restored in about 80 per cent of the properly chosen cases of otosclerosis. The operation should be judged by the great percentage of successful permanent results obtained therewith and not by the occasional failures which must of necessity accompany almost

every surgical procedure because of the human variable.

This operation should not be regarded as just another operative technique added to the list of operative procedures on the temporal bone. It blasts a trail for a new and different type of surgery on the temporal bone. It is based upon different surgical principles than any surgery heretofore employed for the relief of suppurative lesions in the temporal bone. The best results from this surgical procedure will be obtained by otologists who, in addition to an extensive experience in all surgery upon the temporal bone, are possessed of thorough knowledge of the surgical principles pertaining to plastic reconstructive surgery.

In fairness to the already successful development of the surgery for otosclerosis and for the protection of its future, Lempert believes that no otologist, no matter how skillful a surgeon he may be, should attempt this particular operation without having received special training in this type of surgery under supervision and guidance.

NOAH D. FABRICANT, M.D.

**Blashki, E. P., and Clowes, A. L.: The Operative Treatment of Mastoiditis; A Report on Work Done at the Royal North Shore Hospital of Sydney during the Period from January, 1930, to September, 1940.** *Med. J. Australia*, 1941, 1: 443.

In this article the authors record all the cases in which mastoid operations were performed at the Royal North Shore Hospital of Sydney, Australia, over a ten-year period. At least 8 of the 23 patients who died were already moribund when treatment was undertaken. Three others were victims of serious complications at the time of their admission to the hospital. Brain abscesses were diagnosed in 9 instances.

As a general rule, the methods adopted in all of the operations were uniform. The authors emphasize their routine method in acute cases of wound closure with drainage by means of a glass tube in the inferior angle. The fatal cases are reported in abstract form. NOAH D. FABRICANT, M.D.

## MOUTH

**Finocchiaro, R.: Cystic Perithelioma of the Tongue** (Peritelioma cistico della lingua). *Policlin.*, Rome, 1941, 48: sez. chir. 102.

The term perithelioma is applied to tumors presenting an enormous proliferation of the blood vessels, the essential element of which is the multiplication of the cells surrounding the capillaries, which cells have been designated by Eberth as perithelial cells. The basic histomorphological character of these tumors is an endothelial proliferation which in part imitates the normal development of the vessels: there are strands of endothelial cells which are solid at first and become canalized secondarily. This proliferation occurs in a more or less abundant, fibrous, mucoid, and at times chondroid stroma, and the tubular formations filled with blood or lymph differ from normal capillaries by their more copious and disordered endothelial proliferation. Practically, however, the absence of characteristics which can be applied to all cases often makes it difficult to discover the origin of the neoplastic elements, and the difficulties increase when the tumoral tissue assumes a massive form without hematic or lymphatic indications for differentiation, or when progressive or sudden changes occur in the primary structure of the tumor with the appearance of more immature and undifferentiated elements.

Finocchiaro describes a case of angioblastoma of the left side of the tongue, the size of a pigeon's egg. The removed tumor consisted of an oval cystic formation having a thick fibrous capsule; part of the cavity was occupied by small, soft, pink, knobby masses and the same tissue spread from the principal mass to make a thinner lining for most of the remaining part of the cavity. Histological examination of the mass showed an enormous proliferation of packed cells with here and there some small blood and lymph vessels and irregular lacunæ. There was no stroma. More intensely stained strands of cells, running perpendicularly to the vessels and resembling solid vascular buds, stood out on the uniform background of the cell mass; some of these strands showed a beginning of central canalization. The blood and lymph vessels, the lumen of which was lined with typical, normal endothelium, were covered externally by a thick layer of cells decreasing gradually toward the periphery. These cells had a uniform aspect with round or oval nucleus and were more intensely stained close to the vessels; they seemed to proliferate directly at the periphery of the capillaries in perfect continuity with the endothelium from which they were differentiated by the greater homogeneity of their protoplasm, by their nearly constantly round nucleus, and by the gradual decrease of their color toward the periphery.

The peculiar structure of the tumor with its typical elements allowed eliminating mucoid cyst, ranula, and cavernous or cystic lymphangioma, and recognizing the characteristics of endothelioma. The tumor was evidently benign. Its cystic evolution and the presence of a serosanguineous fluid in its cavity were probably due to progressive disintegration of the peripheral parts of the tumor and consequent slow oozing of blood and lymph in the cavity. It was difficult to decide between hematic and lymphatic origin of the tumor, as both elements were present; it is probable that the neoplastic stimulus was exercised simultaneously on all the endothelial elements of the region, and produced a mixed form. The tumor must be included in the group of peritheliomas because the neoplastic proliferation was observed exclusively at the expense of the peripheral elements while the endothelial lining of the vessels remained perfectly normal. The cystic form of angioblastoma of the tongue has not hitherto been reported.

RICHARD KEMEL, M.D.

## PHARYNX

**Martin, H., and Sugarbaker, E. L.: Cancer of the Tonsil.** *Am. J. Surg.*, 1941, 52: 155.

The authors' report is based upon 157 unselected consecutive cases of cancer of the tonsil, including all patients in all stages of the disease who applied to the Memorial Hospital from 1931 to 1935, inclusive. From an analysis of the admission records of the Memorial Hospital, cancer of the tonsil comprises 8 per cent of all cancer of the upper respiratory and alimentary tracts and about 2 per cent of all human cancer. Of the structures of the pharynx, the tonsil (21 per cent) is second only to the extrinsic larynx (37 per cent) in frequency as the site or origin of malignant growths. In the present series the average age was about fifty-seven years on admission and about 30 per cent of the patients were in the sixth decade. Eighty-six per cent of the cases occurred in males and 14 per cent in females, a sex distribution which is almost identical with that of cancer of the tongue.

In growths of the palatine tonsil, as in other forms of pharyngeal cancer, there appears to be no outstanding etiological factor. Hot foods and drink, which are held at least momentarily in the oral cavity, pass rapidly through the pharynx during the act of swallowing. About 70 per cent of the patients admitted the use of tobacco, usually as smokers, but at least this percentage of addiction is found in normal male adults of corresponding age. Only 3 per cent of the Wassermann tests taken gave positive reactions. Poor dental and oral hygiene was observed in the majority of the patients; but since most of them were from the less fortunate economic group, such deficiencies were to be expected, and in the present series were no more prevalent than among the skin-cancer patients in the authors' clinic.

The average duration of symptoms (usually pain or "soreness" of the throat) before admission was seven months, as compared to fifteen months in cancer of the lip, ten months in cancer of the nasopharynx, and five months in cancer of the tongue and of the floor of the mouth, respectively.

Cancer of the tonsil begins either in the tonsil itself or on one of the tonsillar pillars. Small lesions or moderately advanced lesions are the exception. In the average case the growth on admission has a diameter of about 4 cm., so that the exact site or origin cannot be determined, and in these cases the growth has usually invaded the soft palate, both tonsillar pillars, and the adjacent edge of the tongue. In cancer of all parts of Waldeyer's tonsillar ring, metastases play an early and prominent rôle. In the present series about one-third of the patients noted enlarged cervical nodes as the first symptom. On admission clinically demonstrable cervical metastases were present in 76 per cent of the cases. The first node involved (in about 95 per cent of all cases) was the subdigastric, which lies in the upper deep cervical or jugular chain just above the bifurcation of the common carotid artery. Occasionally the first palpable metastatic node appeared in the submaxillary region, and, more rarely, in the middle and lower parts of the deep cervical chain. It is a curious fact that dissemination below the clavicle to the viscera appears to occur only rarely.

A histological classification of the growths in the authors' series showed that the epidermoid carcinomas (84 per cent) and the lymphosarcomas (16 per cent) present about the same relative distribution of these two tumors as in a series of nasopharyngeal cancer recently studied by the authors.

Although a clinical diagnosis is not difficult in the average case of tonsillar cancer, a biopsy should always be made before treatment is instituted. It should be realized that treatment for cancer, whether by radiation or surgery, must be aggressive, and therefore it is always attended by definite risk, discomfort, and expense. Without biopsy the clinical diagnosis will inevitably be erroneous in an occasional case. If the treatment is to be by radiation, not only should a tissue specimen be removed from the tonsil, but an aspiration biopsy should be made for purposes of record to confirm the diagnosis of metastatic nodes. From an analysis of the present series, it is apparent that an erroneous diagnosis of syphilis is made less often in cancer of the tonsil than in malignant growths of the tongue. Gumma of the tonsil (which cannot be differentiated clinically from cancer) is exceptionally rare. Papillomas have a warty papillary appearance, and show a greater tendency than cancer to fungate from the mucous surface. Rarely, patients with leucemia present markedly enlarged tonsils as well as generalized lymphadenopathy, but errors in diagnosis cannot occur with proper laboratory and physical examinations.

There is no structure of the pharynx more accessible to surgical removal than the tonsil, and yet one must conclude from its history that the operative treatment of cancer of the tonsil justifies Despons' epithet of "surgery of despair." The reasons for the failure of surgery in cancer of the tonsil are, first, that the primary lesions are extensive and inoperable when first seen, and, second, that 75 per cent of all cases have metastases on admission. While surgery offers little, radiation therapy is particularly suitable in tonsillar cancer. This area is accessible to irradiation both through the skin of the neck and through the mouth by a peroral portal. Cancer of the tonsil, in general, is among the more radiosensitive of pharyngeal and oral tumors, and the upper portion of the pharynx, in contrast to the hypopharynx, can be heavily irradiated without serious impairment of any vital function or the bringing on of grave complications. The number of permanent cures can be increased and the percentage of untoward sequelæ reduced by the use of submaximal doses of fractionated x-radiation, supplemented in most cases by the implantation of small doses of radon seeds in the residual tumor, either directly into the primary lesion or in the immediately adjacent metastatic nodes.

The net five-year cure rate in the authors' series was 18 per cent. JOSEPH K. NARAT, M.D.

**Montandon, A.: Pendulous Reticulosarcoma of the Lingual Tonsil** (Réticulo-sarcome pendulaire de l'amygdale linguale). *Rev. méd. de la Suisse Rom.*, 1941, No. 1, p. 20.

Montandon reports a case of pendulous reticulosarcoma of the lingual tonsil in a woman sixty-one years of age; the chief symptoms were a sensation of a foreign body in the throat and difficulty in swallowing and in talking. Upon inspection of the oral cavity and throat without any instrument, a tumor was seen which appeared to be attached to the left palatine tonsil. When the tongue was depressed with a spatula, however, the tumor disappeared; the palatine tonsils were entirely normal. Examination with the laryngeal mirror showed that the tumor arose from the lingual tonsil by a short pedicle. Examination of a biopsy specimen from the tumor showed a reticulosarcoma. As the tumor could be surgically removed, and from its histological nature was also radiosensitive, both surgery and radiation were employed in its treatment. After a preliminary x-ray treatment, the tumor was removed by electrocoagulation; postoperative radiation was given in fractional doses until a total of 6,000 roentgens (with 2 mm. of copper filter) were given in 30 treatments. The patient has been kept under careful observation and has shown no signs of recurrence in more than three years.

Tumors of the lingual tonsil are of rare occurrence; tumors of the palatine tonsil occur more frequently, but reticulosarcomas are of rare occurrence in this region. In spite of the fact that reticulosarcomas are known to be radiosensitive, it is a matter of precaution to remove surgically an easily accessible tumor—such as the one in the case reported—and preferably by electrocoagulation, in addition to giving intensive irradiation. This combined treatment has given good results in the case reported in view of the fact that the prognosis of reticulosarcoma is definitely unfavorable. ALICE M. MEYERS.

## NECK

**Cattell, R. B.: The Management of Hyperthyroidism Complicated by Other Conditions.** *Pennsylvania M. J.*, 1941, 44: 685.

The surgical treatment of hyperthyroidism is very satisfactory and the mortality is low, but if hyperthyroidism is complicated the mortality is considerably higher. At the Lahey Clinic approximately 12 per cent of all toxic patients had complications.

More than 100 children, aged thirteen years, or less, have been operated upon for hyperthyroidism. Despite the reluctance of some pediatricians to advise operation, it is important because of the effect of the toxic state upon ossification, and the possibility of a permanent change in the eyes because of the exophthalmos. The child requires a longer period of preparation than the adult; the operation should be done in at least two stages, with an interval between operations of six weeks, and a relatively larger thyroid remnant should be left.

In the aged, exophthalmos is commonly absent; the pulse rate is below 90, and the basal metabolic rate between 15 and 30 per cent. Loss of weight is the best indication of the disease. A long period of preparation is required, after which the operation is done in three stages, with an interval of from four to six weeks between the first and second stage, and six weeks between the second and third stage. The administration of Lugol's solution is continued throughout the period. The operative mortality, even with extreme conservatism, is double that of the total toxic group.

The group with cardiovascular disease can be subdivided into patients without and patients with either congestive failure or abnormal rhythm, or both. Only the latter need special preparation. The pre-operative treatment of these patients is directed toward the relief of the decompensation and the routine preparation with rest, Lugol's solution and a high calory diet. No attempt is made to restore the rhythm to normal by quinidine pre-operatively. From two to three weeks are required for preparation. The operation is done in stages with an interval of six weeks between each stage. The digitalization is continued throughout the interval. Radical subtotal thyroidectomy should be done in all of these cases to obviate persistent or recurrent hyperthyroidism. Cyclopropane is the anesthetic of choice, with a very large admixture of oxygen. The patients are placed into oxygen tents postoperatively. Quinidine is given if the rhythm does not return to normal within four or six days. The mortality rate in this group of patients is 4.3 per cent or five times that of the total group.

Pulmonary tuberculosis is not an uncommon complication. Treatment should be directed to the relief of the hyperthyroidism first. The usual thyroid measures are employed for three weeks. Unless the hyperthyroidism is very severe the operation can be done in one stage. Local anesthesia or cyclopropane is the anesthetic of choice.

Diabetes occurs in 1.5 per cent of thyrotoxic patients. The diagnostic criteria for elderly patients are valid for these cases, occasionally a therapeutic trial with Lugol's solution is necessary, and if the reaction is positive a subtotal thyroidectomy should be advised. Operations in stages are twice as frequent in diabetic patients and the mortality is double that of the general group. The diabetes is usually less severe after thyroidectomy.

Jaundice occurs frequently in hyperthyroidism and the prognosis is serious. If biliary-tract disease is demonstrated its treatment is postponed until after the relief of the thyroid toxicity.

Pernicious anemia is not a frequent complication; if encountered, it should be relieved before operation. Iodine should be continued in the meantime. In severe secondary anemias, the hemoglobin should be raised to 70 per cent before operation is attempted.

Myasthenia gravis is an uncommon complication of serious prognostic significance. Treatment with glycine, ephedrine, and Lugol's solution should be continued for a long time. Operation is done under intratracheal anesthesia. Careful postoperative supervision should be observed, and if there is any evidence of respiratory embarrassment, a tracheotomy should be done at once.

Cancer of the thyroid is merely a coincidental finding. Its treatment in less advanced cases consists in radical hemithyroidectomy of the affected side and in subtotal thyroidectomy of the other lobe. In the more advanced cases the thyroid is extirpated as completely as possible and postoperative irradiation is employed.

In pregnancy, subtotal thyroidectomy is advised up to and including the eighth month; the operation may then be performed (with rare exceptions) in one stage. Women are advised not to become pregnant within one year following a thyroidectomy.

Patients with infections and mild respiratory conditions are candidates for thyroid crisis and should not, therefore, be operated upon. Dental operations should be postponed for a month following thyroidectomy. In the event of acute appendicitis or cholecystitis, patients may be operated upon during the pre-operative period with all due precautions.

Conditions requiring optional surgery should be considered in three to six months following thyroidectomy; operations for urgent conditions, such as malignancies, should be performed in a period of two weeks following thyroidectomy.

Thyroid crisis should be treated as follows:

From 3,000 to 5,000 c.cm. of fluid containing from 15 to 20 gm. of salt are administered by continuous intravenous drip, and morphine and barbiturates are given in adequate quantities. From 200 to 500 gm. of glucose in a 5 or 10 per cent solution are given by the slow drip method, and 100 minims of Lugol's solution daily are considered adequate, 50 drops being added to the intravenous drip; 30 drops may be added to the subcutaneous saline. All patients are placed in tents with an oxygen concentration of from 40 to 50 per cent. The operation, which is always done in stages, is delayed for three or four weeks. FRED S. MODERN, M.D.

**Siedek, H.: Total Thyroidectomy in Cardiac Patients** (Totale Thyreoidektomie bei Herzkranken). *Ergebn. d. inn. Med. u. Kinderh.*, 1940, 59: 1.

Because of the central position of the thyroid in the sympathetic system, the possibility of penetrating into this system by means of total thyroidectomy offered an interesting problem, particularly since in no other category of disease do the sympathetic nerves play a more important part than in cardiac and vascular ailments. In Europe outstanding preliminary work in total excision of the thyroid gland in cardiac patients was done by the schools of von Eiselsberg and Hochenegg. Breitner and Kaspar frequently observed a sudden disappearance of existing cardiac discomforts after thorough extirpation of goiters. Total thyroidectomy was furthermore carried out successfully by Sudeck, Schmieden, Gilman, and Kay. It was remarkable and surprising that manifestations of deficiencies were very rare in older patients, and that the most critically ill were able to stand these interventions well. The author adds the comment that today every internist is acquainted with the fact that all cardiac defects which are accompanied by hyperthyrosis should be operated upon even if the cardiac condition appears critical, and that it is definitely a professional mistake to use only medication in such cases.

In Germany it was *Mandl* who was the first to report on a larger number of cardiac patients who were treated successfully by means of total thyroidectomy. The physician may pursue two courses in the treatment of serious heart defects: either the efficiency of the circulatory system, and particularly of the heart, is strengthened so that the performance meets the requirements; or the requirements are diminished and the circulatory work is reduced either by limitation of muscular exertion or by the use of sedatives. The latter course was pursued by Blumgart who, on the basis of experimental observations, suggested a total extirpation of the thyroid gland in cases of cardiac ailments which would not yield to other treatment. It is to be noted, however, that total thyroidectomy does not result merely in a lowered basic balance and a calmer heart action, but that other manifestations may appear which are by no means welcome.

Zondek and Eppinger have described cases of cardiac myxedema which may result in dilatation and manifestations of failure, symptoms which disappear again after the administration of thyroid preparations. Furthermore, it is important to note that a reduced action of the thyroid gland is accompanied by a pronounced rise of the cholesterin level in the blood. This high cholesterin level should by no means be judged with indifference, particularly in view of the vascular changes which are often observed during the course of myxedema.

Reports of about 450 cases of serious cardiac defects treated to date by total extirpation of the thyroid gland were found in the literature; of these almost 70 cases were from Viennese clinics, while the greatest number were from the American literature. Even after a very careful evaluation of the clinical material observed, there is a 58 per cent improvement in cases with serious cardiac defects, and an 83 per cent improvement in cases of angina pectoris. Therefore the author states that in observing the final results one must concede that total thyroidectomy in cardiac patients represents an absolute therapeutic asset, and that this is particularly striking when one realizes that most of the cases published are considered refractory to other treatments. By proper evaluation of the indications, patients may be promised a 50 per cent chance for improvement, which chance increases considerably with angina pectoris.

More than one-half of the patients who were operated upon were able to return to economic life. If myxedema appears after a total thyroidectomy which, astonishingly, is by no means the case in all such patients, this condition must be neutralized by a carefully graduated administration of thyroid preparations. In cases of angina pectoris and complete thyroidectomy, it is important to ascertain whether the effect of adrenalin upon the sympathetic system has been reduced. Regarding the administration of thyroid substance, it is important to note that in case of myxedema small doses may lower the cholesterin level of the blood, but the basic balance is not increased thereby; the unpleasant danger of vascular sclerosis may thus be averted in time. Postoperative disturbances observed after total thyroidectomy are impotence in men and apoplexy in patients with cerebral sclerosis. Contraindications are, therefore, mainly the scleroses, active coronary defects, active infections, repeated lobar infarcts, and defects of the mitral valves with absolute or prevalent aortic insufficiency.

The author closes his discussions with the statement that cardiac and vascular therapy has taken a new course which should not be disregarded or rejected *a priori*, for it offers an important source of knowledge and, with proper application, most beneficial results.

(SUNDER-PLASSMANN). HILDA H. WHEELER.

**Yoffey, J. M.: The Lymphatic Pathway for Absorption from the Nasopharynx; Absorption of Dyes; Absorption of Proteins; Absorption of Viruses and Bacteria.** *Lancet*, 1941, 240: 529.

Definite functional lymphatic pathways have been found particularly in the case of the deep cervical lymphatics. These have been studied from their origin in the mucous membrane of the nose, accessory air sinuses, and pharynx to their drainage into the deep cervical lymph duct, which in turn empties into the great veins. The cervical duct in man passes through one or more lymph nodes before finally reaching the great veins. To demonstrate the cervical pathway, a solution of a vital dye was dropped into each nostril. At the end of two hours, on dissection of the side of the neck, the pathway was found to stand out sharply. This method actually shows the living and functioning system of vessels.

*Absorption of dyes.* The experiment just described demonstrated the absorption of dye through the normal nasal mucosa. The dye quickly passed through the mucous membrane and entered the lymph and appeared in a cannula in the lymph duct close to the blood stream. Only a few minutes were required for the passage of the dye through the nasal mucosa but there was some delay before it reached the cannula. Some of the dye, after passing through the mucous membrane, was absorbed into the blood stream.

*Absorption of proteins.* Egg albumin with a molecular weight of 34,500 was found to traverse the nasal mucosa and enter the lymph stream just as readily as the vital dye with a molecular weight of 960. Serum albumin with a molecular weight of 72,000± 3,000 was only occasionally found in the lymph stream after nasal instillation. Horse serum dropped into the nose was never detected either in the lymph or in the blood. The fact that the nasal mucosa would let through the vital dye but not horse serum suggested its use as a biological dialyzing membrane. It has been suggested that the vital dye T-1824 in the blood combines in some way with the plasm proteins—a point of some importance in connection with the use of T-1824 in estimating the blood volume. Can sufficient foreign protein be absorbed to induce a state of hypersensitiveness, or if such a state is already present, to bring on anaphylactic shock? The absorption of proteins from the nose also has a bearing on the question of immunization by nasal instillation of toxins and antitoxins. As far as the size of the molecule is concerned, the limit of absorbability seems to be represented by serum albumin with a molecular weight of 72,000. In diphtheria, the toxin has a molecular weight of 70,000 and the antitoxin 150,000.

*Absorption of viruses and bacteria.* Viruses are very much larger than any of the protein molecules and one would hardly expect that they would pass directly through the nasal mucosa. In using one of the larger viruses (vaccinia) this was found to be the case. This is complicated by the fact that one is not dealing with the passage of particles but of particles which are capable of multiplication and direct extension through the mucosa. Apparently during the first twelve hours, the virus is establishing itself by multiplying in the nasal mucosa. With the cervical duct cannulated low down in the neck, it was found that the lymph nodes through which the virus had passed did not appreciably retard or prevent such passage. This passage depends upon two factors. First, the viruses become attached to living cells, in this instance the small lymphocytes. Second, the lymphocytes are continually leaving the lymph nodes in large numbers; therefore, the virus leaves the lymph node in the lymphocytes and not in the fluid lymph. It appears that the chief function of lymph nodes is to act as barriers to noxious particles in the lymph stream and prevent them from reaching the blood. This must be reconsidered. In the case of virus such as that of vaccinia, the lymph node, far from preventing the spread of infection, actually encourages it. Virus reaches the node, multiplies there, and then leaves it and is carried to the blood stream by the lymphocytes in the efferent lymph. The virus may be protected in its passage against any neutralizing principle. Second, the lymphocyte and virus can migrate through the walls of the capillaries in all parts of the body. Third, one of the most striking pathological changes in virus diseases is the perivascular accumulation of lymphocytes. It is possible that the virus-carrying lymphocytes may be responsible for the first introduction of virus in the affected region.

The nasopharynx provides the portal of entry for some of the most common virus diseases: measles,

the common cold, smallpox, chickenpox, and poliomyelitis. In some experiments with the virus of poliomyelitis, which was introduced by intranasal instillation, the virus was never detected in cervical lymph, nor in the lymph nodes. It is possible that poliomyelitis may be specifically neurotropic and that the virus will not function in other than nervous tissue. The presence of virus in the blood limited to the white blood cells has been noted in a number of virus diseases. If the virus employed happens to have developed neurotropic tendencies, a postvaccination encephalitis may be expected to occur.

The absorption of bacteria presents the same general problem as the viruses. The particle size is not the only determining factor for one is dealing with particles which can multiply in a susceptible host. The experimental observation is that some bacteria can pass through nodes and indicates an imperfect barrier function. RICHARD J. BENNETT, JR., M.D.

**Brighton, G. R., Altmann, F., and Hagan, C., Jr.: Reactions of Laryngeal Tissues Following Extended Fractional Roentgen Irradiation.** *Arch. Otolaryngol.*, 1941, 33: 631.

In reviewing 16 cases of intralaryngeal and extralaryngeal neoplasms occurring in men from forty-eight to seventy-eight years of age, the authors observe that in tumors in the early stages protracted fractional irradiation causes rather intensive necrosis of the surface epithelium, damage of the glandular epithelium, and inflammatory reaction mainly of the superficial layers of the mucosa. The latter reaction is characterized by intensive fibrinous exudation with formation of a pseudomembrane and vascular changes of a specific character. Later there is a regeneration of the epithelium as well as more marked fibrosis of the superficial layers of the mucosa, with definite decrease in the subepithelial lymphatic infiltration.

There may also be some obliteration of the small and medium-sized vessels, scattered atrophy of the glandular lobules, and, frequently, chronic edema. Occasionally there may be secondary involvement of the musculature by the fibrosis. However, there are no changes of the musculature, bone, or cartilage primarily due to radiation. The reaction of the tumor tissue is inconsistent with the histological structure but seems connected more definitely with the location of the tumor. The criterion of the location, however, is not sufficient to determine the exact results of irradiation of the tumor tissue.

NOAH D. FABRICANT, M.D.

# SURGERY OF THE NERVOUS SYSTEM

## BRAIN AND ITS COVERINGS; CRANIAL NERVES

**Storch, T. J. C. von, and Karr, H. H.: Reduction of Pain and Other Undesirable Reactions Due to Pneumo-Encephalography.** *New England J. Med.*, 1941, 224: 755.

To secure good encephalographic x-ray pictures without causing violent or dangerous postencephalographic symptoms in the patient is assuredly a goal desired by everyone using this valuable diagnostic procedure.

The authors suggest the use of nembutal or sodium amytal to allay apprehension, and they point out that vomiting can in most cases be avoided by the restriction of anything by mouth and the subcutaneous injection of from 1/150 to 1/50 of a grain of atropine sulfate an hour before the lumbar puncture. Morphine is to be avoided. They like to use a general anesthetic for encephalography, and with the patient in a chair used especially for this procedure and after the administration of atropine sulfate, they *slowly* inject a 5 per cent solution of pentothal sodium in sufficient quantity to produce the desired depth of narcosis. They stress the importance of the *slow* injection of the drug.

They discuss the various gases used for encephalographic studies, among them, air, oxygen, ethylene, carbon dioxide, nitrogen, helium, and freon. They apparently use air in most cases. Ethylene is found to be the least irritating; like oxygen, it is rapidly absorbed and therefore requires fast work in the x-ray department. They point out that the introduction of small amounts of gas will demonstrate only the most obvious lesions; larger amounts, 100 c.cm. or over, cause the severe and prolonged headaches which one commonly finds in these patients, but these larger amounts of gas result in better diagnostic films. The two-needle technique is preferred by the authors, with as little manipulation of the patient as possible during the test.

Postencephalographic measures include the administration of liberal amounts of fluid, sedatives (but no morphine), and the breathing of 95 per cent oxygen to hasten the absorption of the intraventricular gas. JOHN MARTIN, M.D.

**Childe, A. E.: Calcification of the Chorioid Plexus and Its Displacement by Expanding Intracranial Lesions.** *Am. J. Roentgenol.*, 1941, 45: 523.

An analysis of 1,000 consecutive skull examinations revealed calcification to be present in the chorioid plexus in 112 cases (11.2 per cent). In 7.4 per cent the calcification was bilateral. The incidence of such calcification increased in direct proportion to age. The location of this calcification almost always corresponded to the position of the glomus. In lateral roentgenograms the calcification in the glomus was situated above and posterior to the position of the pineal gland, and in anterior-posterior views it appeared from 2.5 to 3 cm. to either side of the midline. The calcified areas varied in size from minute specks to dense areas over 1 cm. in diameter. They were rounded or kidney-shaped and sometimes had a quite typical appearance.

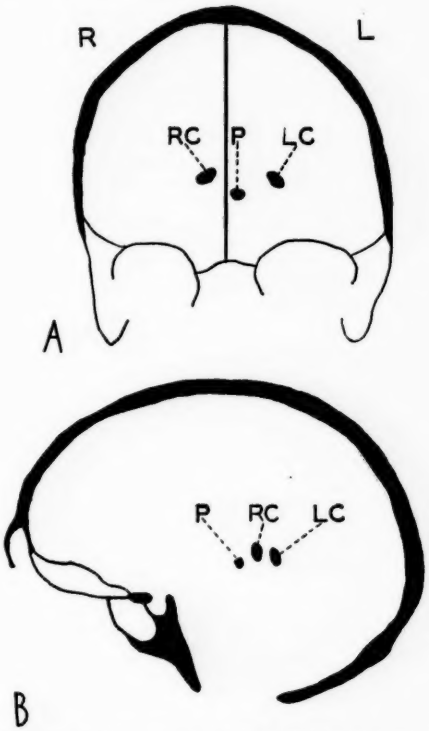


Fig. 1, *A* and *B*. Anterior and medial displacement of calcification in the glomus of the right chorioid plexus produced by a large extradural hemorrhage covering the posterior part of the parietal lobe and also the occipital lobe. *RC*, right chorioid; *LC*, left chorioid; *P*, pineal gland.

Eight cases in the course of twenty-one months showed displacement of a calcified glomus. These cases are reported in detail with skull diagrams showing the locations of the calcified areas. Another case report is included to show that an anteriorly situated tumor, even though it was large, failed to displace the glomus appreciably.

The author states that macroscopic calcification in the chorioid plexus elsewhere than in the glomus is quite rare. Consequently even a minor degree of apparent displacement of such a calcified area sug-

gests a nearby neoplasm. With marked displacement or when the calcification assumes the characteristic rounded or kidney-shaped form the evidence is much more definite. It is difficult to interpret a slight apparent displacement of the glomus when it is unilaterally calcified. True anterior-posterior and lateral films must be obtained since minor degrees of rotation of the skull will give the appearance of displacement. Stereoscopic films are essential to correct interpretation. The lack of demonstrable displacement of the chorioid glomus is not sufficient evidence to exclude an expanding lesion situated in the anterior part of the skull. JOHN L. LINDQUIST, M.D.

**Herren, R. Y.: Papilloma of the Chorioid Plexus.** *Arch. Surg.*, 1941, 42: 758.

In this communication, the author reviews 80 cases of papilloma of the chorioid plexus from the literature and reports 1 case of his own.

Papilloma of the chorioid plexus is a rare tumor, the incidence being not quite 0.4 per cent. It is seen to occur at any age, with a great predilection for the first decades of life.

The tumor occurs with about equal incidence in the lateral and fourth ventricles, next often in the third ventricle. Of the tumors listed as of the third ventricle, 2 had extensions into the fourth ventricle by way of the aqueduct of Sylvius, 2 had extensions into one lateral ventricle, and 2 had extensions into both lateral ventricles by way of the foramens of Monro, so that only 6 were confined to the third ventricle.

Within the first decade of life the tumor occurs almost exclusively in one of the lateral ventricles; in the second, third, fourth, and fifth decades it may occur anywhere, but most commonly in the fourth ventricle.

The percentage of seeding is highest with tumors of the lateral ventricles. This is interpreted as evidence of viciousness in tumors of this location, as is the fact that in one-third of the cases of seeding the phenomenon occurs within the first decade of life. From these observations, it is perhaps justifiable to conclude that had not the tumor killed its host early, the incidence of seeding from the lateral ventricle would be much higher. The explanation for seeding is obscure, but a ready assumption is that trauma to a wildly growing tumor mass within a dilated ventricle (and there is almost universally associated internal hydrocephalus) disengages tumor cells, which are carried away by the cerebrospinal fluid. Seeding appears to take place by way of the cerebrospinal fluid, since all secondary implants, save possibly that in the single case of Hall and Fentress, have shown the nodule to be in the subarachnoid space. The entire number of cases in which seeding occurred represents one-fifth of the cases collected in this article.

Internal hydrocephalus is an almost universal accompaniment of this kind of tumor. This condition obtains whether or not there is mechanical obstruction to the circulation of the cerebrospinal fluid.

It seems more than probable that the tumor mass functions in the capacity of a normal chorioid plexus, and that the associated internal hydrocephalus in those cases in which it is not due to a mechanical obstruction is most probably due to an overproduction of cerebrospinal fluid.

The life history of this tumor shows that it progresses rapidly in the first decade and slowly in the other decades.

The clinical diagnosis of this tumor is a problem indeed. Its rarity causes it not to suggest itself as a diagnostic possibility. It can rarely be lateralized without the aid of air studies. Examination of the cerebrospinal fluid is of little aid in diagnosis. A tumor of this kind should suggest itself in the case of an infant with signs of obstructive or communicating hydrocephalus, particularly when there are lateralizing cerebral signs, and xanthochromic fluid can be aspirated by puncture of the fontanel or other puncture. This type of tumor in the child is extremely vicious in that its symptoms are obscure; it grows to enormous size; it is difficult to handle surgically because of its vascularity; and it causes death quickly. On the other hand, papilloma of the chorioid plexus in the adult is more benign, though often having histologically apparent malignant characteristics.

Ten deaths occurred among 30 operative cases. The greatest morbidity occurs in the middle decades of life, as well as the greatest recovery percentage, since in only a few instances has the diagnosis been made and operation attempted with a patient under the age of ten years. Despite this fact, there does not seem to be a greater morbidity in adults from papilloma of the chorioid plexus than from any other tumor similarly located. Occasionally it recurs.

DAVID J. IMPASTATO, M.D.

**Salém, W.: The Otoneurological Diagnosis in 30 Verified Cases of Tumor of the Brain** (O diagnostico otoneurologico em trinta casos verificados de tumores encephalicos). *Brasil-med.*, 1941, 55: 1.

A study of the labyrinth is very important in certain intracranial lesions which destroy or exert pressure on the centers through which the cochleovestibular nerves pass. In some cases tumors of the posterior fossa or subtentorial tumors may be localized by examination of the labyrinth. The labyrinth is the chief organ of equilibrium and it contributes to muscle tonus. Disturbances of equilibrium or muscle tonus are shown by Romberg's sign, deviations in pointing, vertigo, spontaneous or provoked nystagmus, and the various labyrinth tests devised by Barany which are described in detail.

Little is known of the point of origin or central course of the vestibular nerve. The author, however, gives a diagrammatic sketch of the course of the cochlear and vestibular nerves which is in accordance with the findings of Isaac Jones. In the medulla there are nerve fibers from all the semicircular canals; but in the pons there are no fibers from the horizontal canals, only from the vertical ones. Two cases

which show this are described and illustrated. After caloric stimulation the horizontal canals showed normal postcaloric reactions while those of the vertical canals were completely abolished.

A review is given of 30 cases of brain tumor verified by operation or autopsy and treated in the past two years in the neurological clinic of Austregesilio and the neurosurgical clinic of José Portugal. Eleven of these tumors were in the posterior fossa and 2 in the pons; they were diagnosed by examination of the labyrinth.

The diagnostic value of examination of the labyrinth is lessened if there is a high degree of intracranial tension. Circumscribed tumors of the cerebellum do not cause spontaneous nystagmus. The differential diagnosis between central and peripheral lesions of the labyrinth is discussed. Vertical nystagmus is of central origin. Nystagmus toward the side of the injured labyrinth is central in origin. Spontaneous or provoked nystagmus with predominance of the slow phase is of central origin but is not pathognomonic of a lesion of the posterior fossa. The postcaloric reactions are valuable in localizing a central lesion. Disproportion between the duration of nystagmus and vertigo after rotation is a sign of a central lesion. The loss of vestibular function with preservation of cochlear function suggests a central lesion. The finding of all these clinical symptoms must be supplemented by neurological, ophthalmological, roentgenological, and serological examinations in order to make an accurate diagnosis of localization.

If in intracranial tumors that have been developing for as long as two years there are no cochleovestibular disturbances, tumor of the posterior fossa can be excluded. It is as important to exclude tumor of the posterior fossa as it is to localize it there, as it enables the surgeon to avoid operating through the posterior fossa, which is a difficult and dangerous route. Next to nystagmus, falling, or at least oscillation, is the most important postcaloric sign.

An acoustic chamber for determining the loss of hearing in decibels is described and illustrated.

AUDREY G. MORGAN, M.D.

**Lysholm, E.: Roentgen Picture in Meningioma of the Tentorium** (Das Roentgenbild bei Tentoriummeningeom). *Acta radiol.*, 1941, 22: 303.

Meningiomas of the posterior cranial fossa may be basal, as those of the clivus and those situated laterally to the clivus, or they may originate from the dorsal parts of the fossa, the sigmoid groove, the dorsal part of the petrous bone, or the region of the internal auditory meatus. There are also transitional forms between basal meningiomas and those of the medial part of the petrous bone. Meningiomas which originate from the tentorium are placed in a special group. In his monograph on meningiomas published in 1938, Cushing reports 3 personal cases of meningioma of the tentorium and 1 case described by Toennis. He calls attention to the small number of cases that have been reported up till now and suspects that this gives a false impression of the frequency of occurrence of these tumors; he states that, like the other meningiomas of the posterior cranial fossa, those of the tentorium have a remarkably good prognosis.

Since 1938, Lysholm has observed 4 cases of meningioma of the tentorium which illustrate the various roentgen pictures that may be expected in these cases because of differences in localization and manner of growth. In the first case, a woman, aged fifty years, had had symptoms of brain tumor for five months; clinically, the diagnosis between tumor of the corpus callosum and tumor of the brain stem could not be decided; ventriculography showed a tumor of the right cerebellar hemisphere. Operation in two stages revealed a plum-sized meningioma originating from and not growing through the tentorium.

In the second case, a woman, aged forty-one years, had had symptoms of brain tumor for seven years; the clinical diagnosis was tumor in the third ventricle or below the tentorium; ventriculography showed a tumor in the upper part of the vermis; operation in two stages disclosed a plum-sized meningioma of the tentorium high up in the middle line; the tumor had not grown through the tentorium.

In the third case, a woman, aged thirty-one years, had had headaches, vomiting, double vision, and decrease of vision for four months; objectively she had bilateral stasis papilla. Roentgen examination of the skull showed generally increased pressure and enlargement of the sella turcica, and ventriculography revealed a tumor in the middle line above the fastigium. Operation revealed at this site a meningioma of the tentorium, the size of a hen's egg, which had grown in part through the slit in the tentorium. Subsequent examination of the ventriculogram in the light of the operative findings showed that the supratentorial break typical for cerebellar tumor was absent. The aqueduct was displaced forward more evenly but did not present the type described by the author for tumors of the quadrigeminal plate, and the aspect of the posterior part of the third ventricle resembled more the picture found in pinealoma. Consequently, the ventriculogram showed a tumor in the middle line below the tentorium and its extension above the tentorium, and the specific diagnosis could have been made.

In the fourth case, a man, aged forty-six years, had had headaches, dizziness, and decrease of vision for eight months; the clinical diagnosis was probable meningioma of the right olfactory region; ventriculography showed an occipital and subtentorial tumor on the right; operation disclosed a meningioma, the size of an orange, which had grown through the tentorium.

In cases like the first, in which the tumor originated from the lateral part of the lower surface of the tentorium without growing through it or protruding into the middle cranial fossa, one must be satisfied with a local diagnosis: a specific diagnosis is possible only when typical meningioma calcifica-

tions can be demonstrated. This also applies to cases like the second in which the tumor originated from the middle line without invading the middle-cerebral fossa. However, a specific diagnosis becomes possible in cases in which the meningioma has grown through the tentorium and produced changes in the third ventricle and the aqueduct as in the third case, or in the lateral ventricle, the aqueduct, and the fourth ventricle, as in the last case.

The practical conclusion is that it is necessary to examine the third and fourth ventricles as well as the lateral ones to make a specific diagnosis possible in tumors which displace the occipital horn.

RICHARD KEMEL, M.D.

**Grant, F. C., and Weinberger, L. M.: Experiences with Intramedullary Tractotomy. Relief of Facial Pain and Summary of Operative Results.** *Arch. Surg.*, 1941, 42: 681.

It has long been known from the study of pathological conditions affecting the brain stem that there is an anatomical separation as well as a physiological dissociation of the fibers of the trigeminal nerve immediately on their entry into the brain stem. The fibers conducting the modalities of pain and temperature turn downward and in company with the nucleus of the spinal tract of the fifth nerve run throughout the length of the medulla oblongata and into the upper cervical portion of the cord. During their course, they emerge from under cover of the restiform body and take a superficial position on the lateral surface of the medulla. In this situation they form a distinct elevation on the surface of the medulla—the tuberculum cinereum (Fig. 1). In the closed portion of the medulla the tuberculum cinereum lies below the restiform body and above the olivary eminence. The fibers mediating touch sensation, on the other hand, turn upward at the point of entry into the brain stem, end in the main sensory nucleus of the trigeminal nerve, and, thence, by the secondary neuron, ascend to terminate in the sensory nucleus of the thalamus.

In 1938 Sjöqvist of Stockholm, Sweden, on the basis of his studies on the organization of the central trigeminal system, proposed that section of the descending tract of the trigeminal nerve in the medulla could be used to relieve facial pain. An obvious theoretical advantage of this procedure was that touch sensation could be spared and that the face would not feel cold, stiff, and numb as after section of the sensory root. A second advantage was the sparing of the motor component. A third was the elimination of neuroparalytic keratitis, since some sensation would be retained in the eye. Sjöqvist also expressed the belief that such a central interruption would prevent postoperative dysesthesias. In his monograph published in the same year, he reported on the results in 9 patients in whom the descending tract of the trigeminal nerve was sectioned in the medulla oblongata. Although his results in terms of relief of pain were variable, largely because the operation was a new, untried, and experimental procedure, he established without question that it is possible to render the face analgic and to relieve pain without grossly disturbing touch sensation.

Since his report there have been several other publications on the surgical results and physiological effects of intramedullary tractotomy. Thirty-seven cases have been reported in the literature.

A unilateral suboccipital craniectomy is performed, with removal of the posterior rim of the foramen magnum and the arch of the atlas. After the dura is opened, the arachnoid membrane of the cisterna magna is torn and the cerebrospinal fluid allowed to escape. The tonsil of the cerebellum is gently retracted until the lateral aspect of the medulla with the emerging roots of the lower cranial nerves is exposed and the fourth ventricle is visualized. According to Sjöqvist, the location of the incision is determined by the site of the lowermost vagal rootlet. At this point an incision is made into the lateral aspect of the medulla, beginning just dorsal to the rootlet and extending dorsally for 3.5 or 4 mm. The depth of the incision is from 3 to 4 mm. This cut divides the descending tract of the trigeminal nerve in the tuberculum cinereum and theoretically, at least, avoids the important nuclei and tracts in this neighborhood.

According to the authors this incision is too high and makes it difficult, if not impossible, to avoid injuring the restiform body or the lateral and/or main cuneate nucleus by an incision in this region. The predominant neurological disturbances the authors encountered in the performance of this operation, following Sjöqvist's directions, were due largely to injury of the restiform body. In the last 3 cases they used the obex of the fourth ventricle and the olive as landmarks and cut the tuberculum cinereum at a level of 4 mm. below the obex and about 2 mm. below the olive. This site is from 12 to 14 mm. more caudal than that recommended by Sjöqvist. With this modification the authors have not observed permanent neurological disturbances. The results in 17 cases were as follows:

In 12 cases complete analgesia in the distribution of all three divisions of the trigeminal nerve immediately followed the operation. In a few instances, there were small islands in which a few "pain points" could be found. In 2 cases there were curious combinations of analgesia and hypalegsia which did not conform to the conventional divisional territories of the face. In 1 case the first division was entirely spared, with analgesia of the lower two divisions. In 1 case the sensory result was unsatisfactory, there being only mild hypalgesia in all three divisions.

Touch sensation was found to be slightly decreased in all instances in which analgesia existed, but this was difficult if not impossible to determine with ordinary cotton wool testing. The loss expressed itself as a diminution in the number of touch points per square centimeter, with or without a change in threshold.

The disturbances in temperature sensation were capricious and did not conform to the loss in pain

sensibility. Sometimes with complete analgesia there was fairly good appreciation of temperature, and sometimes there was complete thermanesthesia. Occasionally heat would be appreciated but not cold, or vice versa. In an area of moderate hypalgesia, temperature might be well appreciated or, on the other hand, not at all.

In 15 cases there was complete relief of pain following tractotomy. This included all cases of major trigeminal neuralgia. In 1 case there was marked but not complete relief. In 14 or 15 cases there was a wild in-co-ordination of the homolateral arm. Nystagmus was present in a few instances. The static cerebellar disturbances tended to decrease and by the end of a week were slight in most cases. In several instances, however, in-co-ordination of the arm persisted for a number of weeks. In spite of the absent or greatly diminished static cerebellar signs by the end of a week, the patient showed considerable disturbance in gait. This was out of all proportion to the in-co-ordination of the extremities that was elicited while the patients were in bed. The disturbance in gait was characterized by the patient's standing with the feet apart, staggering and falling to the homolateral side, and peculiarly inclining the upper part of his trunk to the homolateral side, reminiscent of the posture of a person leaning into a strong wind. By the end of two weeks these disturbances in gait had decreased or largely disappeared in most cases.

In 4 cases there was weakness of the homolateral arm, which in 3 persisted past the time of discharge.

In 5 cases the patients complained of numbness and tingling in the homolateral hand and fingers, which again in 3 instances persisted until discharge. In 4 patients with this complaint who were carefully examined, loss or marked diminution of postural sensation was found in the fingers and wrists. A point of considerable interest was that vibratory sensation in these patients was intact.

In 11 cases in which late sensory examinations of the face were made from one to thirteen months after operation, there were a number of alterations. Whereas in the immediate postoperative period 7 of the 11 patients who were re-examined showed complete analgesia of the entire trigeminal field, late examination showed that 5 had analgesia in all three divisions. In 2 cases the analgesia had faded in the third and first divisions, respectively. In 1 case an original analgesia had almost entirely disappeared, leaving only a small patch of hypalgesia beneath the mouth. In another case a profound degree of sensory loss in all three divisions of the face had faded to only a mild hypalgesia in the first division.

Of the 6 patients with major trigeminal neuralgia on whom operation was performed, 4 when last seen from one to eight months after the operation had complete relief from neuralgic pains. One patient complained of paroxysms of burning at the angle of the mouth, which were not distressing. However, because of the slight residual sensory loss in her face, it is possible that her neuralgia may return. One patient, the only patient with trigeminal neuralgia in whose case the authors' treatment failed, had a return of severe neuralgia in the second division after relief lasting eleven months.

Of the 9 patients with malignant disease on whom tractotomy was performed and on whom the authors have follow-up data relating to relief of pain, 5 had complete relief from one to thirteen months after the operation. Two patients had marked though incomplete relief. This was probably due to extension of their carcinoma to other regions of the head, outside the distribution of the sectioned trigeminal tract. Another patient still had a mild degree of pain at the time of his death, one month after operation. This patient had from the time of operation an inadequate sensory loss. Another patient, in whom there was apparently no sensory loss produced by the operation, continued to have unabated pain.

In 9 of 13 cases in which data are available there were varying degrees of neurological disturbance at intervals of from one to thirteen months after the operation. In 4 instances these disturbances were minor. They consisted of occasional lurching, some difficulty in walking on stairs, slight veering of the gait to the homolateral side, a little clumsiness with the homolateral leg in walking, or a little difficulty in performing complicated tasks, such as typewriting. In 5 cases, however, the disturbances were more severe. There were 2 such cases among those in which operation was done for trigeminal neuralgia. One patient required the use of a cane to venture out on the street, although he was able to get around his house easily. He stood with feet apart and tended to stagger to the homolateral side, and his trunk was inclined to the side operated on. After another eleven months following the operation he was unable to walk without support. This patient, however, had symptomatic trigeminal neuralgia engrafted on multiple sclerosis. Although he had had marked ataxia of both legs before operation, and it was therefore difficult to appraise the effect of the operation on the neurological picture, the fact remains that he was more ataxic after operation than before. Three patients operated on for malignant disease had marked neurological disturbances. Two were unable to walk without support and had marked in-co-ordination in the homolateral extremities at the time of their deaths, one and two months, respectively, after operation. One was able to walk unsupported eight months after operation but staggered considerably. He stood with feet apart and his trunk inclined to the homolateral side. He also had hemihypalgesia of the opposite side of his body; this was the only instance in this series in which there was a Wallenberg syndrome produced by the operation. Four patients were entirely free of neurological disturbances six and one-half, five and one-half, three, and thirteen months, respectively, after operation.

The neurological sequelæ of tractotomy as described here might seem to preclude its use. However, the suggested shift in the position of the incision into the medulla has enabled the authors to re-

lieve the pain in the last 3 cases of trigeminal neuralgia with few and minor resulting disabilities. If further experience indicates that the asynergic and dysmetric complications can be reduced to this extent, a definite place exists for this procedure.

Not infrequently patients are encountered who complain of a burning sensation in the face between the paroxysms of major neuralgia. According to the authors, frequently after relief of pain by root section this burning sensation continues as a dysesthesia in the anesthetic area. For such patients tractotomy may be particularly indicated, because the absence of subjective sensory change in the face following this procedure as compared to the total anesthesia accompanying root section may go far to prevent aggravation of the burning dysesthesia. This persistent dysesthesia is a very distressing sequela to root section.

If a patient has trigeminal neuralgia in all three divisions, tractotomy should be considered, because the corneal reflex is spared and keratitis avoided. In the rare instances in which the neuralgia has recurred on the opposite side of the face, the initial pain having been cured by complete sensory and motor-root section, the recurring pain can be relieved by tractotomy without any possibility of damage to the remaining motor root. When a cancer of the mouth, of the base of the tongue, or of the mandible is present and requires a suboccipital craniotomy for section of the fifth, ninth, and posterior cervical roots for relief of pain, tractotomy is easier to perform than transection of the trigeminal root at the pons.

Under these limited conditions, therefore, a very real place for medullary tractotomy may be found in the treatment of trigeminal neuralgia. Because of the potential neurological sequelæ following a badly placed incision into the medulla, this procedure will never be used routinely even by those experienced with it. However, every neurosurgeon dealing with many patients with trigeminal neuralgia should know how to perform this maneuver whenever the proper indication for its use exists.

DAVID J. IMPASTATO, M.D.

## MISCELLANEOUS

**Russell, H.: Observations on the Classification of the Gliomas.** *Edinburgh M. J.*, 1941, 48: 145.

The examination of a collection of slides of 300 gliomas brought into relief the value of the old subdivision of these tumors into glioma and gliosarcoma, terms for which gliocytoma and glioblastoma may be substituted today.

The gliocytomas are tumors containing relatively mature glia elements such as astrocytes and oligodendrocytes.

The glioblastomas contain immature glia cells ranging from undifferentiated forms, such as are seen in the wall of the neural tube in the early embryo, to astroblasts. It is suggested that there is no true subdivision of the glioblastomas, and that the variety of cell shapes found in them is merely evidence of some degree of differentiation within a tumor which arises in a tissue possessing great potentiality for differentiation. The term glioblastoma is adequate to describe all the variations which appear, but it does not exclude the use of qualifying adjectives such as isomorphic, heteromorphic, and astroblastic to indicate dominant or conspicuous cell elements.

The neuroblastomas of the eye and brain, which appear to be so closely allied to the isomorphic glioblastomas, have been classed here as a separate group. Eventually they have to be studied in relation to the neuroblastomas of the sympathetic system, and that is beyond the scope of this study.

It is suggested that if the terms glio-epithelioma or neuro-epithelioma are to be retained they should be applied to ependymal and choroidal tumors which show the fundamental pattern of a tissue in which the cells appear to form the lining of a surface.

SAMUEL H. KLEIN, M.D.

# SURGERY OF THE THORAX

## CHEST WALL AND BREAST

**Parsons, W. H., and McCall, E. F.: The Role of Estrogenic Substances in the Production of Malignant Mammary Lesions.** *Surgery*, 1941, 9: 780.

Evidence increasingly tends to accentuate reported experimental work on the carcinogenic activity of the estrogens as regards their role in the production of malignant mammary lesions. Many able investigators have been able to produce, employing strains of mice capable of developing spontaneous mammary carcinoma, malignant neoplasms of the breast in male mice by continued estrogenic therapy. It has been possible also to reduce the age level at which such strains would ordinarily develop adenocarcinoma of the breast. Other investigators have produced malignant lesions of the breast in rats possessed of no hereditary tendency toward the development of spontaneous cancer. Still others have shown that human beings under prolonged estrogen therapy undergo definite breast and genital changes, which may eventually lead to the development of malignant lesions.

At the present time it would seem unwise to draw definite conclusions regarding the actual production of malignant lesions in the human being as a result of prolonged or massive estrogen therapy. Before such a position would be tenable, more careful study will be necessary to evaluate the already accumulating case reports; but from the evidence now at hand it would seem that the indiscriminate use of the hormones is certainly not beneficial to the majority of the patients on whom they are used and may actually be harmful. Certainly, these hormones should be employed with judicious care.

Although definite proof of the role of the estrogens is lacking in the case of a white woman fifty-four years of age, which case was reported by the author, one would suspect at least that the estrogens may have played a very major etiological role in the development of the malignant mammary adenocarcinoma that was present. JOSEPH K. NARAT, M.D.

## TRACHEA, LUNGS, AND PLEURA

**Farberov, B. E., and Baslow, E. A.: Primary Tumors of the Lungs; Roentgen Diagnosis and Therapy.** *Am. J. Roentgenol.*, 1941, 45: 701.

After briefly discussing the pathology, symptomatology, and diagnosis of primary tumors of the lungs, the authors present the findings in 130 such cases which came under their observation. Of this number 124 were carcinomas, 3 sarcomas, 2 fibromas, and 1 lymphangitis sarcomatosis. The cases are analyzed as to the symptoms suggesting the condition, methods used for its recognition, and the associated metastases.

The following roentgenological signs were considered of importance: a dense solitary shadow on one side of the chest, displacement of the organs of the mediastinum during inspiration, rise of the diaphragm on the side of the lesion, paradoxical movement of the diaphragm, and metastases in the bones, lymph nodes, and other organs. Attention is called to errors made in connection with the roentgenological diagnosis. Individual cases are cited in detail to illustrate the difficulty of arrival at correct conclusions in some instances. The value of sputum examinations is stressed. Complications such as atelectasis, pleural effusions, and necrosis are given consideration.

The different types of carcinoma of the lung are discussed at length in regard to the roentgen findings associated with them. The helps which bronchoscopy, bronchography, kymography, and serial examinations can give are all mentioned. As to the differential diagnosis, actinomycosis, chronic pneumonia, lues, lymphogranulomatosis, tuberculosis, pneumoconiosis, abscess or gangrene of the lung, and interlobar empyema are among the conditions which may produce similar findings.

As regards roentgen therapy in primary carcinoma of the lung, the authors' experience is practically the same as that reported by others. Palliation rather than cure is the most irradiation can offer. In 44 proved cases thus treated, the average period of survival after diagnosis was about eight months, whereas 21 untreated patients of the same group survived only five and a half months. The influence of roentgen therapy on the clinical symptoms is beneficial. In many cases the dyspnea diminishes, pain disappears or diminishes, and sometimes even the cough disappears and the temperature becomes normal. The general condition of the patients is often improved; they gain weight and even return to work. However, there are cases in which roentgen therapy produces no results and the symptoms are even aggravated. In some cases there is regression of the pathological process. Although the results obtained to date are mainly palliative, the authors believe this method of treatment should be used.

ADOLPH HARTUNG, M.D.

**Gebauer, P. W.: The Differentiation of Bronchiogenic Carcinomas.** *J. Thoracic Surg.*, 1941, 10: 373.

The author has correlated the clinical, roentgenological, and bronchoscopic features of the three types of bronchiogenic carcinomas in this paper.

The small-cell carcinoma most frequently arises in the main stem bronchus, less frequently near the orifice of a secondary branch, and rarely in a small branch bronchus. It forms an irregular mediastinal mass, is highly invasive, extends along the bronchus, and metastasizes early to adjacent, regional, and distant lymph nodes. Early symptoms are cough

and vague thoracic sensations. Hemoptysis, hoarseness, dyspnea, wheezing, and dysphagia are late symptoms. The average age of the patients is forty-seven years.

Roentgenologically, an irregular mass is seen early; it blends with the mediastinum and does not have a sharp outline. Surrounding inflammatory infiltration is scanty but may be extensive. Atelectasis is not common. Invasion and distortion of the mediastinum is more likely to be seen.

Bronchoscopically, extreme distortion and fixation of bronchus is seen. Late in the disease the tracheobronchial tree is fixed, the trachea compressed, the carina widened, and the main bronchus compressed.

Surgically there is little hope that many cases may be cured by excision.

Adenocarcinomas arise in secondary bronchi in 70 per cent of the cases, in small bronchi in 20 per cent, and in the main bronchi in 10 per cent. They extend peripherally as well as centrally. They frequently form a well circumscribed mass, which appears as a nodule in the lung. Lymphatic metastasis is extensive and blood-borne metastases are frequent. Pleural effusion is common. Hemoptysis and pleural pain are early symptoms. The average age of the patients was fifty-one years and the average duration of life eight months after onset of notable symptoms.

The early roentgenogram frequently displays a sharply circumscribed dense mass separate from the mediastinum, and there is usually no evidence of mediastinal involvement. Late in the disease it resembles other types except that it frequently produces secondary nodules.

Bronchoscopy may be entirely negative despite a fair-sized tumor. If the tumor has perforated the bronchus a positive biopsy will be obtained. Late in the disease there will be fixation and distortion of the tracheobronchial tree.

Surgically, these tumors are most favorable for excision, particularly if located in the periphery of the lung.

Squamous-cell carcinoma originates in the first branches of the main stem bronchus in 70 per cent of the cases. The average age of the patients was fifty-five years and the average duration of life twelve months. The tumor grows more slowly and metastasizes more slowly and less extensively than the other two types described. It frequently shows cavitation. The earliest symptom is usually a productive cough with blood-streaked sputum. The onset is insidious. Infection produces fever, cough, and weight loss.

Roentgenologically in early cases a nodule is seen in the lung; it is not entirely peripheral and is less sharply circumscribed than the adenocarcinoma. Surrounding inflammatory infiltration is common. Occlusion of a secondary bronchus with lobar atelectasis, necrosis, and cavitation is frequently seen.

Bronchoscopically, a positive biopsy may be obtained in early cases except when the upper lobe bronchi are involved. The tumor is usually an ulcerous stenotic lesion with its site of origin deep in the bronchus and a conical constriction above it. When infection supervenes the bronchus appears contracted, angry, red, and stenotic.

Surgically, this is the type best suited for surgical removal. The slow growth, deep origin in the bronchi, and late metastasis allow a better chance for complete excision and cure.

Gebauer has pointed out that symptoms of cancer of the lung occur early. Bronchoscopy will lead to a positive diagnosis only in from 40 to 50 per cent of the early cases, and roentgenograms, bronchograms, aspiration biopsy, and even exploratory thoracotomy must be resorted to early in the course of the disease if the diagnosis is to be made while the carcinoma is still a local disease. Removal of the whole lung is the only known cure for cancer of the lung.

JULIAN A. MOORE, M.D.

**Weinberg, L. I.: Peripleuritis.** *Nov. khir. arkh.*, 1940, 47: 253.

Peripleuritis or parapleuritis is a suppurative inflammation of cellular tissue located between the costal pleura and intrathoracic fascia on one side and the chest wall on the other side. The course of the process is either subacute or chronic, the first type being caused by pyogenic bacteria and the second mostly by tuberculosis. Any region of the chest wall may be affected and the process may occupy one or a few intercostal spaces or even the entire half of the thorax. In 1 of the author's cases the abscess contained air, apparently deriving from a perforated cortical pulmonary abscess.

The first symptom of peripleuritis is usually pain in a circumscribed portion of the chest, aggravated by movements of the body, deep inspiration, and cough. The tumefaction gradually increases in size and a fluctuation may appear. The overlying skin either retains its normal color or an erythema develops. If the underlying lung and pleural cavity remain intact, the findings on percussion and auscultation of the surrounding regions remain normal, while a dullness and feeble respiratory sounds are found over the tumefaction and the vocal fremitus is diminished.

The amount of pus may range from a few to as many as 1,600 c.cm. The infectious process spreads through the lymphatic paths in a lateral direction or toward the outside, but not inward. Apparently a primary peripleuritis originates in deeply seated lymph glands of the thoracic wall. In some instances the infection may involve the peripleural tissues by continuity or contiguity from adjoining regions, especially from the lungs.

The differential diagnosis between peripleuritis and circumscribed empyema of the chest must be based on the following points:

1. A widened intercostal space points to peripleuritis.

2. A single opening is characteristic for empyema of the chest, while multiple spontaneous perforations

and the formation of fistulas are sometimes found in peripleuritis.

3. The pus from an empyema cavity is thinner and has a lower specific gravity than that of peripleuritis.

4. The lower border of empyema is always formed by the lower limits of the pleura while a peripleuritic abscess may be located higher.

5. The upper border of dullness over empyema frequently runs in a horizontal direction across the entire width of the involved side of the chest, which is not the case in peripleuritis.

Peripleuritis cannot be differentiated clinically from osteomyelitis of the ribs and only roentgenograms can establish the correct diagnosis. During inspiration the abscess caused by peripleuritis becomes flattened while on expiration its size and tension increase.

The treatment of peripleuritis consists of an incision, supplemented if necessary by a rib resection. Both cases observed by the author had a fatal outcome.

JOSEPH K. NARAT, M.D.

## ESOPHAGUS AND MEDIASTINUM

**Ochsner, A., and DeBakey, M.: Surgical Aspects of Carcinoma of the Esophagus; a Review of the Literature and Report of 4 Cases.** *J. Thoracic Surg.*, 1941, 10: 401.

The authors have presented a complete review of the history of the experimental and clinical work done on carcinoma of the esophagus. They have reviewed particularly the development of the surgical technique employed in removing the esophagus.

In their opinion only two types of surgical procedures should be considered, namely, the thoracico-abdominal and thoracico-cervical operations.

In all the world's literature there have been reported 195 cases, including the authors' cases, in which resection of the esophagus was done. One hundred and forty patients died as a result of the operation, an operative mortality rate of 71.8 per cent. The percentage of five-year cures is not given.

Four cases are reported by the authors; 3 of their patients died and 1 is living eighteen months after operation.

JULIAN A. MOORE, M.D.

# SURGERY OF THE ABDOMEN

## ABDOMINAL WALL AND PERITONEUM

**O'Leary, C. M., and Clymer, C. E.: Umbilical Hernia.** *Am. J. Surg.*, 1941, 52: 38.

In a survey of 80,000 admissions at the University Hospital in Oklahoma City, 62 umbilical hernias were encountered. Of these, 7 were congenital, 22 infantile, and 33 of the adult type. An additional 84 cases from the literature are reviewed.

One case of congenital umbilical hernia may be found in every 5,000 deliveries. Most of the cases reported were of embryonic origin, while a few were probably of fetal origin. Other congenital defects were present in about one-third of the cases. Careful inspection of the cord will preclude ligation of a loop of intestine in the hernial sac. The hernial wall is composed of two avascular layers separated by Wharton's jelly, and the sac may be occupied by several organs. Although in most instances the diameter of the neck of the sac is less than 5 cm., many patients present a large defect. The hernial defect must be closed early, preferably within the first six hours. Delayed surgery, resection of the bowel, or incomplete closure of the defect usually results in mortality. The sac structures are removed, the hernial contents are reduced, and the wound is closed in layers by means of an intraperitoneal operation. No other surgery should be attempted if it can be avoided.

Umbilical hernias of the infantile type are usually noted during the first or second month of life. Although other evidences of maldevelopment are infrequent, about 30 per cent of these infants will have bilateral inguinal hernias as well. Truss support should be instituted. If a cure does not result, operation is justified, but not before the child is five years of age. The technique of repair consists of eradication of the sac, apposition of the recti muscles, and transverse overlapping of the fascia.

The adult type of umbilical hernias usually begins between the ages of twenty and thirty. Obesity and multiple pregnancies are important etiological factors. The defect is usually small and is situated at the point of the obliterated umbilical vein in the umbilical cicatrix. The hernial coverings consist of peritoneum, transversalis fascia, and skin. About 1 of every 8 umbilical hernias will strangulate, which raises the mortality from 1 to 3 per cent for simple umbilical hernia, to between 30 and 50 per cent for cases with strangulation.

Adequate weight reduction and the use of abdominal binders in voluminous hernias for a period of time is advisable pre-operatively. Transverse overlap of the fascia is conceded to be the best type of repair, after the contents of the sac have been returned to the abdominal cavity and the peritoneum has been closed. Postoperative abdominal distention is treated by continuous gastric suction by means of the Levine nasal tube. The patient must remain in bed for at least three weeks, wear an elastic belt for a year or longer, and avoid any undue weight gain. This method is followed by a recurrence rate of about 10 per cent.

S. Lloyd Teitelman, M.D.

## GASTRO-INTESTINAL TRACT

**Loi, L.: Changes in Gastric Acidity Caused by Cholecystogastrostomy and Cholecystoduodenostomy for Calculosis of the Bile Tract** (Sulle modificazioni dell'acidità gastrica determinata dalla colecistogastro e dalla colecistoduodenostomia per calcolosi delle vie biliari). *Policlin.*, Rome, 1941, 48: sez. chir. 57.

The author discusses the previous experimental and clinical work on gastric acidity and then reports 20 cases of his own. In 16 of these cholecystogastrostomy was performed for calculosis of the bile tract and in 4 cholecystoduodenostomy was done. He gives tables showing the details of the findings at various periods after operation.

Following the cholecystogastrostomies there was a tendency toward an increase of free hydrochloric acid and of total acidity in the stomach as compared with the pre-operative findings. Such an increase was seen in 12 of the 16 cases. No definite conclusions are given in the cases of cholecystoduodenostomy because of the small number of cases.

These increased acid values are of special significance because patients with gall stones are, as a rule, anacid or hypacid. It may be assumed that the improved conditions of stomach secretion are brought about chiefly by retrogression of the gastritis and the anatomical and functional lesions of the liver which are found so frequently in patients with gall stones. This is accomplished by the internal derivation of the bile brought about by the operation.

Audrey G. Morgan, M.D.

**Sovena, E.: A Clinical Contribution to the Study of Phlegmonous Gastritis** (Contributo clinico allo studio della gastrite flemmonosa). *Policlin.*, Rome, 1941, 48: sez. chir. 109.

Phlegmonous gastritis is rare and little known despite the numerous works published on the subject during the past twenty years. It is an extremely grave disease which is usually characterized by a sudden, dramatic beginning with violent epigastric and hypogastric pain, nausea, and repeated vomiting followed by signs of circumscribed or diffuse peritonitis, intense general symptoms, and high fever. The disease presents no characteristic signs which allow making or suspecting the correct diagnosis; the literature reveals that the absence of clinical diagnosis is the rule in these cases. Sovena describes the case of a habitual drinker, aged twenty-nine years,

in whom the diagnosis of acute peritonitis due to perforation of gastric or duodenal ulcer was made. At operation, he found an acute phlegmonous gastritis which was limited to the antropyloric region and which he resected with good results.

The disease may occur at any age but is found especially between the ages of twenty and sixty years; it involves men three times out of four and its predisposing causes are supposed to be previous chronic gastritis, especially alcoholism, and possibly the ingestion of certain drugs, such as potassium iodide, oxalic acid, or turpentine. Phlegmonous gastritis may be primary, secondary, or metastatic; its usual bacterial agent is the streptococcus, and infection may take place through the blood stream or by direct inoculation of the mucosa from a traumatic, chemical, or thermal lesion, or the solution of continuity due to a pre-existing ulcer or cancer. The disease has been reproduced experimentally by the combination of three factors: the notable decrease of the gastric acidity obtained by roentgen irradiation, a traumatic lesion, and the massive introduction of virulent streptococci by mouth.

The primary seat of the inflammatory changes is the submucosa in which the pus is formed; the result is marked thickening of the gastric wall. The submucosa may become a vast abscess and the other layers of the gastric wall may be more or less altered by the inflammatory process; the mucosa is usually respected, but may be the seat of hemorrhages, edema, erosions, necrosis, and fibrinous stratifications, or punctiform perforations may occur through which the pus empties into the stomach. The muscular layer may be infiltrated and subsequently destroyed; the subserosa and the serosa may become involved with resulting peritonitis. In the circumscribed form, usually in the antropyloric region, the gastric wall may be enormously thickened, and show a striking difference between the phlegmonous and the healthy part. At times, the circumscribed form involves the fundus or the cardia.

Clinically, a distinction must be made between the acute and the subacute form, the latter having a less violent course. The acute form starts suddenly with grave symptoms from the beginning (atrocious colicky pains, nausea, hiccup, vomiting, high fever, and at times chills) and runs an impressive course. The general symptoms appear rapidly and blood examination reveals a leucocytosis of from 20,000 to 30,000. In short, on the first day the functional signs are gastric, the physical signs are epigastric, and the general signs are already grave; on the second day there are no more signs of intramural infection, but diffuse signs of spreading infection and of generalized peritonitis for which it is difficult to find a starting point and a supramesocolic maximum (Mondor). Death occurs from four to six days after the beginning of the symptoms.

The treatment is surgical: an exploratory laparotomy must always be performed unless the patient's condition is hopeless. When the acute phlegmonous gastritis is diffuse, gastric resection is technically impossible and simple tamponing of the peritoneal cavity around the infiltrated gastric wall is indicated, eventually associated with gastrotomy to drain the submucosal space but with care not to cut the mucosa, or the entire stomach may be covered with the omentum and the gastric recess may then be drained. In case of acute suppurating diffuse peritonitis, suprapubic drainage is advisable. In acute phlegmonous gastritis of antropyloric localization, without peritonitis or with beginning and circumscribed peritoneal lesions, in young patients who are in good general condition, resection and gastrojejunal anastomosis in healthy tissue are indicated. If there is diffuse peritonitis, ample drainage of the gastric recess and tamponing of the infiltrated gastric wall are recommended; eventually, gastrotomy to drain the submucosal space, jejunostomy in case of pyloric stenosis, and suprapubic drainage if necessary are indicated. If the circumscribed phlegmon is localized in the fundus and the cardia, tamponing of the involved gastric portion and jejunostomy are the only solution. In circumscribed abscess of the gastric wall in which the local and general conditions do not allow resection, the abscess is opened from the outside and drained. Energetic medical treatment must be instituted from the beginning. In subacute cases, resection is indicated in the circumscribed forms and abstention in the diffuse forms.

The global mortality of the disease reaches 92 per cent according to Sundberg, while the statistics of Gerster on operative cases up to 1927 shows 46 deaths and 13 recoveries. The author has found in the literature from 1927 until now 36 operative cases with 20 deaths and 16 recoveries.

RICHARD KEMEL, M.D.

**Reid, M. R.: The Use of Clinical Material for the Investigation of Gastric Cancer.** *J. Nat. Cancer Inst.*, 1941, 1: 523.

The author points out and discusses the fact that only in recent years has the medical profession begun to realize that the study of human material may approach in accuracy and controlled conditions the study of laboratory animals in the investigation of many problems. He shows that human material is especially valuable in the study of cancer.

The Gastric-Cancer Clinic at the University of Cincinnati was established in 1936 for the special study of human material as regards gastric cancer and other conditions with a possible etiological bearing upon gastric cancer, i.e., peptic ulcer, atrophic gastritis, achlorhydria, and pernicious anemia. The personnel and equipment have gradually been organized and expanded so that now every patient admitted to the Clinic receives a full and thorough laboratory, x-ray, and gastroscopic examination by specially trained men in each field.

A method of pathological examination is described whereby large microscopic sections of the entire stomach are made and carefully studied as surgical and autopsy specimens of gastric disease, both cancerous and possibly precancerous. A technique of

fixing the stomach with formalin immediately after death is described.

Special attention is paid to dietary habits. The nutritional state of the gastric cancer patient is assayed and, if possible, corrected before therapeutic measures are instituted, especially surgery.

The supplementary value of both gastroscopic and x-ray studies is emphasized by citation of cases in which a diagnosis was missed by either one or the other, and of 3 cases in which it was missed by both. Two case reports supporting this idea are given in detail.

It is pointed out that no single laboratory test is infallible and that all such tests should be evaluated for what they are worth and no more. They have far greater positive than negative value. No good clinician will be swayed by them if they go contrary to his clinical judgment. EARL GARSIDE, M.D.

**Collins, S. D., Gover, M., and Dorn, H. F.: The Trend and Geographic Variation in Cancer Mortality and Prevalence, with Special Reference to Gastric Cancer.** *J. Nat. Cancer Inst.*, 1941, 1: 425.

This paper summarizes briefly and in graphic form the results of certain statistical studies of cancer, with special reference to gastric cancer. These studies by the United States Public Health Service pertain to (1) the trend of cancer mortality (a) since 1900 in the ten States and the District of Columbia, for which records are available, and (b) since 1920 in different geographic areas; (2) the variation from State to State in cancer mortality from 1930 to 32; and (3) the prevalence of cancer cases under treatment in twelve urban areas classified into three geographic regions.

The recorded mortality from all cancer has increased steadily since 1900. The cancer death rate among males has increased more rapidly than that among females; in 1935 the male rate was 87 per cent of the female rate, as compared with 59 per cent in 1900.

The recorded death rate from cancer of the stomach and liver among females increased from 1900 to about 1920, but decreased after that time. This decrease has affected chiefly persons under sixty-five years of age; among females above seventy-five years of age the death rate has definitely increased. Among males the recorded death rate from cancer of the stomach and liver increased until about 1922, but there has been a slight decrease since that time. This decrease has affected chiefly the age groups under forty-five years; among males above fifty-five years the death rate has definitely increased.

The decreases since about 1922 in mortality from cancer of the stomach and liver among males and females occurred in each geographic region except the South, where there has been no decrease for males and only a slight decrease for females.

The highest recorded death rates from cancer of the stomach and duodenum from 1930 to 32 occurred in the northern states from the Atlantic to the Pacific. In the southern states the rates are uniformly low, Louisiana being the only one that does not fall among the 11 lowest states. The other sites of cancer of the digestive system also show high death rates in the north, although in some sites they do not show so much higher rates in the northwestern states as is the case in gastric cancer.

At the other extreme is skin cancer, for which all of the southern states have the highest mortality rates. The mortality rate from cancer of the buccal cavity, except of the lip and jaw is likewise relatively high among females in all of the southern states, but among males there is no great contrast between the North and the South.

With regard to all cancer, resident cases under treatment per 100,000 of the white population in the surveyed areas amounted to 282 in the North, 386 in the South, and 425 in the West. This showing is in contrast to the death rates of 124 per 100,000 of the surveyed population in the North, 97 in the South, and 151 in the West. Thus, the South shows a lower cancer death rate but a higher rate of cancer under treatment than the North. JOSEPH K. NARAT, M.D.

**Griswold, R. A., and Antoncic, R. F.: Perforated Peptic Ulcer.** *Ann. Surg.*, 1941, 113: 791.

One hundred and eleven consecutive cases of perforated peptic ulcer observed at the Louisville City Hospital from 1931 to 1940 are analyzed in this report. The authors have studied their cases critically and now submit the present surgical procedure which they have evolved from their own experiences and from a study of the literature.

Their procedure today consists of the following:

1. A short transverse incision under novocaine block anesthesia, supplemented when necessary by a small amount of cyclopropane.
2. Thorough removal of intraperitoneal fluid, including that in the pelvis, by suction rather than with sponges.
3. Simple closure of the ulcer with two layers of interrupted silk sutures from the proximal to the distal side, so as not to encroach upon the lumen of the pylorus. This suture line is reinforced by catching omentum in the outer layer of sutures.
4. From 5 to 10 gm. of sulfanilamide crystals are sprinkled about the lesion and from 3 to 5 gm. are implanted in the abdominal wall.
5. No intraperitoneal drains are used.
6. The abdominal wall is closed in layers with silk, without drainage, and a non-constricting dressing is applied.
7. A Levine tube is passed into the stomach just before or after operation, and left there for from twenty-four to forty-eight hours. If ileus from peritonitis supervenes, the use of the tube is continued.
8. If the peritoneal culture shows the streptococcus, sulfanilamide is pushed by any available route.
9. Pulmonary complications are combated by such measures as frequent turning of the patient,

and carbon-dioxide inhalations; bronchoscopic aspiration is indicated if atelectasis occurs.

10. The salt and fluid balance are carefully controlled.

11. Transfusions of blood or plasma are administered freely when indicated.

One hundred and two patients were operated upon. There were 20 deaths, 10 of which were secondary to peritonitis. The peritoneal fluid was cultured in 65 cases. In 34 cases, no growth was found. The streptococcus or a streptococcal mixture was reported 18 times; in this group there were 8 deaths.

The final conclusion was that aside from the age of the patient and delay in operation, the most important factor in the mortality is the presence of the streptococcus in the peritoneal cavity. Next in importance are pulmonary complications.

SAMUEL J. FOGELSON, M.D.

**Segelman, S. Y.: Simple Ulcers of the Small Intestine.** *Nov. khir. arkh.*, 1940, 48: 45.

Simple ulcers of the small intestine are characterized by their non-specific character, complete absence or minimal signs of inflammatory processes in the vicinity, obscure etiology, and presence of the common bacterial intestinal flora. This definition excludes syphilitic, tuberculous, typhoid, dysenteric, and actinomycotic ulcers as well as those of a traumatic origin (from pressure by fecal masses, distention of the intestines, or perforation by parasites), or of a toxic nature (from uremia and various poisonings). Some authors include in the group of simple ulcers the so-called peptic ulcers which are analogous to similar formations in the stomach.

Simple ulcers of the small intestine are rare. The author describes 3 cases, all of them in men from thirty-one to forty-one years of age.

The ulcers occur chiefly in the male sex. Marked clinical symptoms appear only after perforation or some other complication and therefore the lesions remain unrecognized for a long time. Sudden pain suggests a perforation, and the absence of typical gastric ulcer points to an involvement of the intestinal tract. Pain localized in the lower abdomen suggests a perforation of the intestines and not of the stomach.

JOSEPH K. NARAT, M.D.

**Horsley, J. S.: Resection of the Duodenum for Tumor of the Ampulla of Vater.** *Ann. Surg.*, 1941, 113: 802.

To a short review of the history of surgery for tumor of the ampulla of Vater and head of the pancreas, Horsley adds a report of a case operated upon by him.

While Coffey pioneered in the experimental work, it was not till 1922, that Mann and Kawamura developed a technique for excision of the duodenum and transplantation of the common and pancreatic ducts in one stage. The operation of Whipple, Parsons, and Mullins was based on physiological data. Originally it was undertaken in two stages during the first of which the gall bladder was anastomosed to the stomach and a gastro-enterostomy was performed, and at a later stage excision of the duodenum and head of the pancreas, and ligation of the pancreatic duct were done. Since then, Whipple has modified the procedure by uniting the gall bladder to the jejunum, instead of the stomach, and again improved on the technique by uniting the common duct to the jejunum, so as to obviate the danger of a troublesome leak in the ligated stump of the common duct.

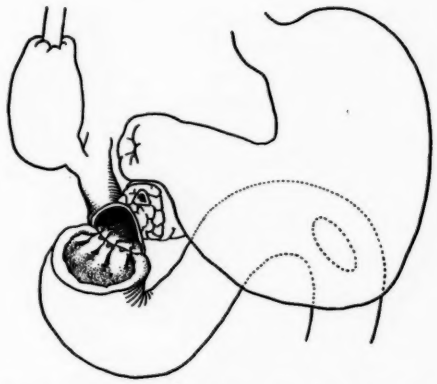

Fig. 1. In the operation performed in the reported case, the distal stump of the duodenum was sutured to the greatly enlarged common duct. The undilated pancreatic duct is shown in the stump of the pancreas near the common bile duct. (Courtesy of J. B. Lippincott Co.)

Horsley's patient was sixty years old and presented deep jaundice of seven weeks' duration. At operation the gall bladder contained white bile; no stones were found, but the duodenum was contracted and presented a small mass in the region of the ampulla of Vater. It appeared resectable, but since the infiltration extended into the pancreas, it was decided to resect a segment of duodenum including the ampulla, and the head of the pancreas. After closure of the proximal duodenal stump, the dilated common duct was sutured end-to-end to the posterior wall of the distal duodenal stump; the anterior wall was then closed about the free edge of the common duct stump and the proximal surface of the resected pancreas. Precaution against leakage was exercised by the use of omental grafts and a posterior gastro-enterostomy was done. A rubber tube was introduced into the gall bladder which had been opened for exploration during the early part of the operation.

The author's patient died on the fifth postoperative day. However, the operation in the case reported was in effect an attempt to preserve the external secretion of the pancreas, inasmuch as Horsley believes that cases not requiring extensive resection of the pancreas might lend themselves to this procedure.

ANTHONY F. SAVA, M.D.

**Hunt, E. L., and Kaneb, G. D.: Primary Adenocarcinoma of the Jejunum.** *New England J. Med.*, 1941, 224: 353.

The authors report 3 cases of primary adenocarcinoma of the jejunum in which the lesion was resected and the bowel continuity restored by end-to-end anastomosis with no operative mortality. Two of the patients are now alive twelve and seven and one-half years after the operation. The third patient died from bone metastases two years and four months after operation.

Although this lesion is relatively rare it should always be considered as a possibility when one is confronted with a gastro-intestinal problem, because early diagnosis and adequate treatment yield favorable results.

There are no pathognomonic symptoms of the disease. The first manifestations may be only weakness and fatigue. Intermittent cramps in the region of the umbilicus associated with borborygmi are frequent. Considerable time may elapse between eating and the onset of these cramps. Other symptoms of a lesion in the intestinal tract may be present, namely, anorexia, constipation, occult blood in the stool, vomiting, weight loss, and secondary anemia. Physical examination generally reveals abdominal distention and visible peristalsis accompanied by cramps and borborygmi. A palpable freely movable tumor mass, when present, is significant. X-ray studies may show delayed passage of barium and dilatation of the portion of small intestine which is proximal to the lesion. Simple films of the abdomen to elicit the presence of gas may reveal the typical stepladder pattern of obstruction.

The essential treatment of adenocarcinoma of the jejunum is wide resection and re-establishment of intestinal continuity by some form of anastomosis. The operative procedure should be supplemented by supportive measures to satisfy normal physiological requirements of blood and tissue fluids and by Miller-Abbott or Wangensteen intubation methods of decompression. EDWARD W. GIBBS, M.D.

**Black, C. E.: Appendicitis.** *West. J. Surg., Obst. & Gynec.*, 1941, 49: 197.

The mortality rate of appendectomy varies widely, from 12 to less than 1 per cent; the lowest rates are usually in the reports of individual operators, the highest in the reports of groups. A part of the explanation for this variation is due to the following:

1. Delays in arriving at a diagnosis and in sending patients to the hospital.
2. Poor judgment in evaluating the resistance of the patient.
3. Inadequate pre-operative preparation of the patient.
4. Poor technique.
5. Inadequate postoperative support.
6. Improper administration of anesthesia.
7. Multiple operations. In the 3,148 cases studied, in which the appendix was removed, 689 other operations were done at the same time.

It is suggested that some surgical organization should appoint a special committee to study the whole question of appendicitis. A first step should be a standard classification of the diseases of the appendix, in order that reports could be accurately compared. The committee should outline methods which would obviate the present inconstant results, by formulating standardized procedures drawn from the methods, suggestions, and experience of various hospitals and surgeons. SAMUEL KAHN, M.D.

**Hillman, R. W.: Oxyuriasis of the Appendix; A Clinical Study of 31 Cases.** *Brooklyn Hosp. J.*, 1941, 3: 83.

Though the infestation of man with oxyuris vermicularis, or pinworm, has long been recognized, it is only recently that evidence has accumulated which, while not demonstrating a specific pathological process, has definitely shown the organism to be responsible for a clinical entity, "oxyuris appendicitis."

The incidence of oxyuris infestation of the intestinal tract has been variously reported from 11.35 to 57.3 per cent. Reports on incidence in the appendix vary from 0.0 to 48 per cent, the figures including both appendices acutely inflamed, and "normal" appendices removed incidentally.

The author examined 1,601 appendices over a four-year period at The Brooklyn Hospital, of which 1,294 were suspected of harboring appendicitis and 307 were removed incidentally to other surgery. Thirty-one instances (2.39 per cent) of oxyuris were found in the former group and none in the latter, though 2 cases in "normal" appendices have been found since completion of the series.

Sixty-one and three-tenths per cent of the patients gave a definite history of recurrent abdominal symptoms over a period of eighteen months. All complained of abdominal pain, and approximately half complained of nausea and vomiting. Upon admission only 19.4 per cent were acutely ill, but in 90.3 per cent abdominal tenderness was present. Localized tenderness was present in only half of the cases. The average leucocyte count was 11,429, with an average normal percentage of polymorphonuclears.

Pathological examination revealed that, except for the presence of the organism in the lumen (essential for diagnosis), there is no pathological picture characteristic of oxyuriasis of the appendix; in fact there is usually an entire absence of inflammatory changes. Symptoms are conceivably produced by hyperperistaltic movements of the appendix attempting to rid itself of the parasite. It is also probable that chronic complaints may be due to a generalized infestation of the lower bowel, though the more severe episodes must be caused by appendiceal involvement *per se*.

Thus it appears that oxyuriasis of the appendix occurs chiefly in girls of school age and adolescence. Patients presenting the usual picture give a history of recurrent attacks for one or two years, complain of

mild abdominal pains with nausea and often vomiting for several days prior to admission, do not appear acutely ill, have normal temperature, moderate abdominal tenderness, and show a slightly elevated total white count.

The considerable variation in the clinical picture makes positive differentiation from acute suppurative appendicitis impossible. EARL GARSIDE, M.D.

## LIVER, GALL BLADDER, PANCREAS, AND SPLEEN

**Murakami, T., and Uchiyama, H.: Functions of the Extrahepatic Bile Ducts and Secretory Function of the Liver. Clinical Study on the Relation Between the Duodenal Movements and the Evacuation of Bile into the Duodenum During Fasting. Experimental Study of the Relation Between the Movements of the Duodenum and the Functions of the Biliary Tract During Fasting.** *Arch. Surg.*, 1941, 42: 693, 703.

The relation between the movements of the duodenum and the discharge of bile in man during fasting was studied by means of a duodenal tube made up of an outer tube used for inflating a balloon and an inner tube for drainage of the duodenal fluid. The movement of the duodenum is periodic, with three regularly repeated phases,—active, tetanic, and resting,— or non-periodic, with continuous change from the active to the tetanic phase. Bile out-flow was seen only during periods of duodenal activity, periodic when the duodenal movement was periodic, and irregular but almost continuous when the duodenal movement was continuous. To distinguish between periodic and non-periodic movements is difficult; both show changes due to numerous physiological factors so that it cannot be readily said which is normal. When, during fasting, no bile is observed in the duodenal drainage fluid despite continuous movement of the duodenum, it may be assumed that a pathological condition is present in the biliary tract. "Hypertonic dyscinesia" of the biliary tract is indicated unless a complete obstruction of the biliary tract is observed.

The second paper presents results obtained in fasting, unanesthetized, intubated dogs in an investigation of the evacuation of bile, the contraction of the gall bladder, the resistance of the sphincter of Oddi, and the duodenal movements. Double intubation of the common duct was carried out without injury to the gall bladder, and at the same time a duodenal fistula was made, or a small balloon was placed inside of the duodenum opposite the papilla of Vater. The investigations were carried out 16 times on 14 animals. A periodic relation between the duodenal movements and the evacuation of bile was seen in 8 cases, non-periodic types of activity were noted in 5 cases, and there was no evacuation of bile despite continuous movement of the duodenum in 2 cases.

During the resting period of periodic duodenal movement the intracholedochal pressure showed a continuous decrease of from 30 to 80 mm. of water pressure, according to the relaxation of the gall bladder, and remained almost constant in each case. During the active phase the pressure became intermittent, with tonic or rhythmic rises corresponding to the spontaneous contractions of the gall bladder. At the peak of such rises (from 120 to 200 mm.) bile flowed intermittently into the duodenum. The resistance at the distal end of the common duct during the resting phase of the duodenum was from 80 to 240 mm., and during the active period remained about the same except for waves of variation in pressure (from 120 to 270 mm.). When the duodenal movements became vigorous and entered the tetanic phase resistance rose in the several high waves, reaching from 200 to 500 mm.

With the non-periodic types of duodenal movement intracholedochal pressure (when the gall bladder was relaxed) was in some cases from 60 to 80 mm. of water. In these cases the rhythmic or tonic pressure waves rose at intervals of 10 to 20 minutes, reaching from 120 to 160 mm. and lasting from several minutes to one-half hour. In other cases the pressure remained continuous. The resistance at the distal end of the common duct was from 80 to 150 mm., with occasional variations ranging from 120 to 300 mm.

With the abnormal types of activity, despite the almost continuous movements of the duodenum, there was no evacuation of bile. The intracholedochal pressure was irregular and extremely variable (from 200 to 300 mm.), according to the incessant contractions of the gall bladder, while the resistance at the distal end of the common duct appeared over 320 mm. with waves reaching 500 mm. of water pressure.

WALTER H. NADLER, M.D.

**Klusemann, E.: Clinic on Atresia of the Biliary Tract** (Zur Klinik der Gallengangsatresien). Dusseldorf: Dissertation, 1939.

This is a presentation which, following a dissertation on the normal and abnormal developments of the liver and biliary-tract systems and a discussion of the clinical, differential diagnostic, prognostic, and therapeutic features thereof, analyzes 2 personal cases in addition to cases from the literature.

In 2 nursing infants intense and increasing jaundice developed after three weeks with a progressive decline in the physical well-being. Death occurred after a short time. Clinically everything pointed to an obstruction of the bile passages, and autopsy confirmed the clinical diagnosis of congenital biliary-duct atresia. A connection between the duodenum and common duct could not be demonstrated grossly or microscopically.

The chief clinical symptoms are: jaundice, the appearance of direct bilirubin in the blood, biliuria, absence of urobilin, colorless duodenal chyme, and acholic stools. The affliction is practically hopeless but, therapeutically, operative reports determine a further course of action. A passage for bile must be

fashioned through the gall bladder or biliary-duct system to the stomach or intestine. At the same time in most cases there are advanced cirrhotic changes in the liver which prejudice an already doubtful operative risk. As an explanation of biliary-tract atresia, the persistence of epithelial occlusion of the extrahepatic biliary ducts, which is physiological in the second fetal month, is postulated. This is entirely in accord with clinical observation. An extensive bibliography accompanies the original article.

(HEINEMANN-GRUEDER). JOHN L. LINDQUIST, M.D.

**Lord, J. W., Jr., and Andrus, W. DeW.: Changes in the Liver Associated with Hyperthyroidism, with a Study of Plasma Prothrombin Levels in the Immediate Postoperative Period.** *Arch. Surg.*, 1941, 42: 643.

Various reports concerning morphological damage to the liver and impairment of hepatic function that accompany hyperthyroidism are reviewed. Of 680 patients with hyperthyroidism who were subjected to some form of operation on the thyroid gland in the past eight years, 16 have died, 8 in typical thyroid crises. Necropsies were performed on 6 of these patients. All of the livers showed moderate to marked amounts of yellow mottling and microscopically, the three outstanding observations were large droplets of fat diffusely distributed in the parenchymatous cells, central necrosis of the hepatic cords with marked infiltration of the necrotic area by polymorphonuclear leucocytes and red blood cells, and a moderate to marked degree of connective-tissue proliferation in the portal spaces with accumulation of lymphocytes.

The authors believe that the response of a lowered level of plasma prothrombin to intramuscular injection of 2-methyl-1, 4-naphthoquinone is a most sensitive measure of hepatic function. A series of 36 consecutive patients with hyperthyroidism and 34 controls were studied by means of the level of plasma prothrombin as determined by the Warner, Brinkhouse, and Smith test. Impairment of hepatic function, according to this test, was noted after operation in 29 of the 36 patients in the former group.

The influence of the carbohydrate-fat ratio of the diet and of the Vitamin B complex on the liver is discussed. The authors suggest that in the preparation for operative treatment of the patient with hyperthyroidism a high caloric, high carbohydrate, high protein, and low fat diet, supplemented with liberal amounts of Vitamin B complex, be used.

WALTER H. NADLER, M.D.

**Doehring, P. C.: Macroscopically Non-Pathological Gall Bladder; A Clinicopathological Study.** *Arch. Surg.*, 1941, 42: 665.

A study of almost 2,000 cases in which cholecystectomy was performed, irrespective of why it was performed, revealed that in approximately 18 per cent stones were not found and that almost a third of these (5.75 per cent of the total) showed no gross pathological lesions and could not be distinguished grossly from normal. A macroscopically non-pathological gall bladder may be found at operation even in the presence of a history typical of gall-bladder disease with biliary colic, jaundice, and tenderness in the right upper abdominal quadrant. Half of the patients with apparently normal gall bladders gave a history typical of disease of the gall bladder, a third of them had typical biliary colics, and another third gave a history of jaundice. The author has considered several possible explanations of these symptoms although no new evidence is offered. Half of the patients showed evidence of nervous exhaustion or neurotic tendencies. Almost 90 per cent of the cholecystograms showed normally functioning gall bladders. There was no constant relation of the operative findings to any of the pre-operative findings. No evidence was found to support the view that hepatitis as described at the time of operation is of any significance, either in relation to the pre-operative findings or to the prognosis.

Microscopically, all specimens showed varying degrees of lymphocytic infiltration, although there was no relation between the degree of infiltration and the pre-operative findings, operative findings, or prognosis. The results of cholecystectomy in this study are similar to those found by others in similar cases and the good results are fewer than in those cases in which definite pathological lesions or stones were present. Fifty-five per cent of the patients were cured, 21 per cent were benefited, and 23 per cent obtained no relief. The operative mortality was 1 per cent. There is no way to predict either before or at operation which patients with macroscopically normal gall bladders will be relieved of their symptoms following cholecystectomy. Regardless of the way in which the cases are grouped, approximately 1 of 4 received no benefit from operation.

**Fernícola, C., and Tenconi, E.: Roentgenological Diagnosis of a Spontaneous Fistula Between the Gall Bladder and Duodenum, Caused by Biliary Calculus** (Fístula espontánea colecistoduodenal por cálculo biliar. Diagnóstico radiológico). *Rev. Asoc. med. argent.*, 1941, 55: 35.

The case of a woman of thirty-seven who for ten years had had symptoms of acute cholecystitis is described. These symptoms had been followed for the past three months by stomach symptoms. She was sent to the hospital on account of nausea and vomiting. A probable diagnosis of gall stones associated with stenotic ulcer of the pylorus was made. Cholecystography was negative. Serial roentgenograms of the stomach and duodenum did not show any organic lesions. However, there was a round, intensely opaque shadow about 3 cm. to the right of the bulb of the duodenum, with which it was connected by a discontinuous filiform shadow. Apparently this shadow was caused by a gall bladder partially filled with barium and connected with the duodenum by a fistula. Supplementary examinations were made to confirm this diagnosis. The roentgenograms are reproduced. Operation was

performed under spinal anesthesia, and recovery was uneventful.

In all cases of biliary ileus the existence of a fistula between the gall bladder and duodenum should be suspected and the proper measures taken. Diagnosis, which is difficult, must be based on signs of lithiasis followed by those of biliary ileus and a careful roentgen examination. A negative roentgen examination does not prove the absence of cholecystoduodenal fistula. The prognosis is serious and death may result if operation is not performed promptly.

AUDREY G. MORGAN, M.D.

**Sjögren, S. E.: A Diverticulum-Like Formation in the Choledochus, Demonstrated by Cholangiography** (Divertikelaehnliche Bildung am Choledochus, nachgewiesen durch Cholangiographie). *Acta radiol.*, 1941, 22: 318.

Anomalies of the biliary tract are often observed, but usually offer little interest from the roentgenological point of view. Anomalies which consist of cystic formation in the biliary tract are rare and have hitherto been found nearly exclusively at operation or autopsy; they are seldom demonstrable with the usual roentgenological methods of examination, such as cholecystography and plain exposures. Lately, cholangiography during operation has been used with increasing frequency; it will provide a large amount of information about the malformations of the biliary tract, provided that all cases which deviate from the normal are faithfully reported in the roentgenological literature.

Sjögren describes the case of a woman, aged thirty-nine years, in whom cholecystectomy had been performed because of gall stones five years previously, and recurrence of pains motivated an exploratory laparotomy one year later; except for adhesions, nothing abnormal was found. The attacks of pain continued and had increased in frequency and intensity. During all this time, no icterus or discoloration of the urine or feces was observed. On admission, roentgen examination of the abdomen disclosed only a large duodenal diverticulum in the region of Vater's papilla. At operation, no pathological changes were discovered in the biliary tract by palpation, and no gall stones were found; the choledochus was incised and sounded and a large pocket was found on its posterior wall. Cholangiography showed that the hepatic duct and the choledochus were not enlarged but were filled with contrast substance which reached the duodenum and the duodenal diverticulum; part of the pancreatic duct was visible. At the posterior aspect of the choledochus and about 4 cm. above the papilla of Vater, there was an oval, cystic formation, about 4 cm. long and 3 cm. wide, connected with the choledochus at its lower pole; the connecting portion was decidedly narrower but its opening was rather wide (Fig. 1).

Fig. 1. (1) Hepatic duct, (2) Choledochus, (3) Duodenum, (4) Duodenal diverticulum, (5) Pancreatic duct, and (6) Choledochus diverticulum.

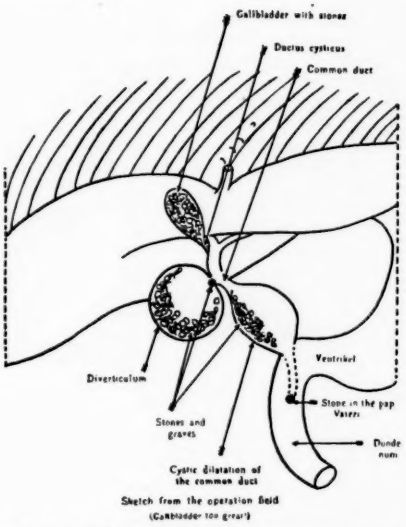


Fig. 2. Cystic dilatation of the common duct.

At a certain stage in the embryonic development of the biliary tract, the choledochus presents relatively often numerous epithelial nodules and diverticular formations; these structures are found especially in the region of the junction of the cystic duct with the choledochus and regress during further development. However, they offer embryonic possibilities for the origination of a diverticulum of the choledochus by persistence and subsequent development of one of these superfluous fetal forma-

tions. To the knowledge of the author, diverticulum of the choledochus formed after the fetal period has been described once by Budde, who found a small diverticulum of the lowest part of the choledochus lying within the duodenal wall, and once by Söderlund; the latter's case (Fig. 2) corresponded exactly with the present one, and these are the only 2 cases of diverticulum of the choledochus observed up to the present time in adults.

These cases offer a theoretical interest for the etiology of another choledochus anomaly, i.e., congenital idiopathic dilatation or the so-called choledochus cyst, known in the Anglo-Saxon literature as diverticulum of the common bile duct. This anomaly is also rare. The 2 cases of diverticulum of the choledochus seem to contribute to filling the gap between fetal diverticular formations and congenital idiopathic dilatation of the choledochus.

RICHARD KEMEL, M.D.

**Franco, S. C.: Carcinoma of the Head of the Pancreas; A Review of 40 Cases.** *Am. J. Digest. Dis.*, 1941, 8: 65.

Carcinoma of the head of the pancreas often mimics other abdominal disease and is an obscure type of abdominal neoplasm. In the author's series of 40 cases the diagnosis was established by autopsy, biopsy, or by the presence of abdominal metastases. More than half of the patients were in the sixth decade of life. The sex distribution was 23 males and 17 females. There was a past history of gastric illness in 8 patients, gall-bladder disease in 4, recurrent indigestion in 3, and jaundice in 1 patient. More than 25 per cent had had symptoms for a month or less on admission, while 2 patients had had symptoms of eight months' duration. The most common symptoms were abdominal pain, jaundice, severe weight loss, and a change in bowel habit. A few patients presented a painless jaundice. In the absence of jaundice, diagnosis was difficult because the x-rays often failed to reveal any localizing lesion. Physical examination revealed fever in one-half of the patients, jaundice in 31, and an enlarged liver in 27. An enlarged gall bladder was present in 16 cases, and a palpable epigastric mass other than the liver or gall bladder was found only five times.

As in the case of obstructive jaundice, urobilinogen was absent in the urine. It may be present, however, in the event of severe liver damage, and a case not included in this series is cited as an example. Clinically, the persistent absence of urobilinogen in the urine in the presence of icterus over a period of two weeks indicates obstructive jaundice. With severe hepatitis due to other causes, temporary obstruction of bile canaliculi may cause urobilinogen to disappear from the urine, but if the patient survives the urobilinogen reappears. No study was made of pancreatic ferments in this series. In regard to other laboratory tests, glycosuria was found in 3 cases and achlorhydria in 6 cases.

In 10 of 26 patients subjected to gastro-intestinal x-ray study, there were normal findings. The abnormal x-ray findings in the remainder were principally located about the duodenum and pylorus.

Operative treatment consisted usually of anastomosis of the gall bladder to the stomach or duodenum. Gastro-enterostomy was also performed, in addition, in a number of patients because of the tendency toward duodenal obstruction by tumor growth.

From the onset of symptoms to the death of the patient the average lapse of time was two and a half months. This was shorter than in most series, and the author believes it was due to the high incidence of operative intervention. Earlier diagnosis with earlier exploration would allow a greater percentage of resections in an attempt to cure the disease.

JOHN L. LINDQUIST, M.D.

**Della Maggiore, B.: The Permanent Good Effect of Ligation of the Splenic Artery in an Ascitic Splenohepatic Syndrome** (Effetto favorevole e duraturo della allacciatura dell' arteria splenica in sindrome spleno-epatica ascitogena). *Policlin.*, Rome, 1941, 48: sez. med. 56.

A man of thirty-five years was admitted to the hospital with the abdomen enlarged from ascites. He had enlargement of the liver and spleen of the congestive sclerotic type in the early ascitic stage with marked signs of impairment of liver function. He was in poor general condition with remittent fever. On the first examination of the blood there were 3,910,000 red cells and 4,300 leucocytes; the color index was 0.80.

The hemolytic action of splenic type, the disturbed condition of the splenic and portal circulations, and the cirrhogenic action of the spleen on the liver were the factors which seemed to indicate operation on the spleen in this case. Ligation of the artery would decrease the action of the spleen without the dangers involved in splenectomy. Therefore this ligation was performed.

A table is given which shows the details with regard to the blood findings at various periods up to four years after the operation. At the end of the four years the blood picture had returned to normal, the patient was in good general condition, the spleen and liver had decreased in size, and the function of the latter was normal. Therefore the ligation of the splenic artery seemed to have had a permanent good effect.

AUDREY G. MORGAN, M.D.

## MISCELLANEOUS

**Berk, J. E., Rothschild, N. S., and Doane, J. C.: Intra-Abdominal Apoplexy.** *Ann. Surg.*, 1941, 113: 513.

The authors report a case of massive spontaneous intraperitoneal hemorrhage, together with a study of 19 cases collected from the literature.

The patient was a man, fifty-two years of age. On admission to the hospital he complained of constant, dull, diffuse, abdominal pain of three days' duration, associated with vomiting on one occasion

only. There was no history of previous digestive trouble. Hypertension had been present for several years.

The blood pressure was 240/170. There were cardiac and arterial changes characteristic of hypertensive disease. The abdomen was flat and relaxed. Some epigastric tenderness was present. A leucocytosis of 16,000 with 86 per cent neutrophiles was present.

Five days after admission to the hospital an elevation of the temperature to 103°(F), as well as abdominal distention without increased pain, was noted. Thirteen days after admission the patient had sudden severe non-localized abdominal pain, vomiting, and partial collapse. The blood pressure was 90/70, the abdomen was moderately distended but not tender. No physical signs of intraperitoneal fluid could be demonstrated. Audible peristalsis disappeared. Operation was carried out after the patient had reacted to treatment for shock. The presumptive diagnosis was mesenteric thrombosis.

More than 1,000 c.cm. of blood were removed from the peritoneal cavity. Complete exploration failed to reveal the site of hemorrhage and the abdomen was closed without drainage. There was some postoperative shock; otherwise recovery was essentially uneventful except for abdominal distention, hydrothorax, and anasarca, presumably due to protein and vitamin deficiency.

From their study, the authors conclude that this diagnosis should be considered in all cases in which there is sudden, severe abdominal pain, shock, and signs of peritoneal irritation, especially in the presence of known hypertension. There is nothing pathognomonic about the signs or symptoms that would permit a definite pre-operative diagnosis. This is well illustrated by the fact that in none of the collected cases was there a correct diagnosis made prior to operation. It is probable that hypertension and arteriosclerosis are the dominant factors in the etiology of the condition. The authors suggest the possibility of rupture of small aneurysmal dilatations as a cause in younger individuals. Early operation and control of the bleeding point, if possible, is indicated. If the bleeding point is found the chances for recovery are good. JOHN A. GIUS, M.D.

# GYNECOLOGY

## UTERUS

**Bodemann, W.: Uterus Solidus** (Uterus solidus). Jena: Dissertation, 1940.

The author's report includes a general and a historical consideration of the development of the female genitalia and anomalous formations as well as a summary of the congenital and acquired epithelial defects of the uterovaginal canal. It then gives the history of a nineteen-year-old woman with a solid uterus who complained of severe attacks of dysmenorrhea. Upon palpation the uterus in this case was found to be practically normal; however, the vagina ended in a blind pouch which had no connection with the cavum uteri. The operative findings revealed a normally sized uterus, but transverse sections disclosed that it had no lumen. Both macroscopic and microscopic sections revealed a picture of intramural adenomyosis.

The author assumes that during earliest embryonal development a trauma had occurred which interfered with the normal growth of the cavum uteri. (K. Heising). Mathias J. Seifert, M.D.

**Kneer, M.: The Effect of Follicular Hormone Upon the Function of the Human Myometrium** (Wirkung des Follikelhormons auf die Funktion der menschlichen Uterusmuskulatur). *Arch. f. Gynaek.*, 1940, 170: 483.

Examinations were made of the reactions of the uteri of 19 women having an approximately four-week cycle, to 1.5 units of orasthin by means of the intra-uterine balloon method; these examinations were then immediately followed by endometrial biopsy.

A positive reaction to orasthin occurred only at the beginning and at the end of the cycle, that is, from the second to fifth, and from the twenty-sixth to twenty-eighth days. No influence upon the uterus appeared during the remainder of the time. Elevation of the intra-uterine pressure frequently produced enlargement (active dilatation) of the cavity.

The same examinations were conducted on women with more infrequent periods. The reaction to orasthin was observed in those cases in which the histological findings in the endometrium implied ovarian quiescence, hence, inactivity of both the follicular and corpus-luteum hormones.

Four women with amenorrhea received follicular hormone; the uteri grew and gradually became capable of modulation by elevated intracavitary pressure. Uteri conditioned in this manner did not contract following injections of orasthin.

The uteri of 24 women with glandular hyperplasia gave positive reactions, chiefly at the time of bleeding; during the amenorrheic intervals the reactions were negative.

The uterus acquires the capacity for positive reaction probably only when the follicular-hormone level drops. The author reaches the following conclusion:

So long as the follicular hormone exerts an effect upon the uterus, there is a stimulus to growth of the muscle fibers and to hyperplasia of the interstitial tissue; at this time no contraction which raises the intracavitary pressure is to be expected in response to extract from the posterior pituitary lobe unless it is followed by a lapse which leads to dilatation of the cavity. If the follicular hormone is omitted, the growth impulse stops and the muscle fibers regress; a contracting stimulus leads to reduction in the size of the cavity.

Strips of muscle excised from human uteri reacted indiscriminately, positively or negatively, to the addition of orasthin to the fluid in which they were suspended, regardless of whether the endometrium was in a proliferative or secretory phase.

Measurements of the intracavitary pressure in 4 uteri with incomplete abortions revealed that injections of orasthin led to contractions only when the pressure reached a certain height (this pressure was elevated by increased distention of the system).

In the opinion of the author, labor occurs if the stimulus to further longitudinal growth of the muscle fibers and to the development of interstitial tissue disappears. The same impulse which previously effected an active dilatation, that is, enlargement, of the cavity as a result of uncoiling of the spirally arranged muscle fibers, evokes an elevation of the intracavitary pressure following depletion of the follicular-hormone effect; thus, labor is set in motion.

The author makes a practical application of this concept by administering 1 mgm. of follicular hormone every two weeks in cases of threatened abortion.

(Buettner). O. Theodore Roberg, Jr., M.D.

## ADNEXAL AND PERIUTERINE CONDITIONS

**MacFee, W. F.: Benign Tumors of the Ovary Associated with Ascites and Pleural Effusion.** *Ann. Surg.*, 1941, 113: 549.

The case of a fifty-four-year-old woman with a large multilocular cystadenoma of the ovary, ascites, and right pleural effusion is reported. She was treated by aspiration of the fluid from the pleural cavity and operative removal of the left ovarian tumor and the right ovary. There was no microscopic or other evidence of malignancy. The pleural cavity was again aspirated ten days after the operation and since then (after eleven months), there has been no further accumulation in the chest or abdomen and the patient has become entirely well.

It is pointed out that the syndrome of benign ovarian tumors, ascites, and hydrothorax is now a

recognized one. Fifteen cases have been reported and collected from the literature by Meigs. The present case is exceptional in that all the other reported tumors have been fibromas. This is the first cystadenoma reported as part of this syndrome.

RICHARD WARREN, M.D.

**Platz, J.: Six Additional Cases of Primary Carcinoma of the Tubes** (Ueber sechs weitere Faelle von primaerem Tubencarcinom). *Arch. f. Gynaek.*, 1940, 170: 604.

The author reports on 6 cases of primary carcinoma of the tubes which were treated at the Second Clinic of the University of Munich in the period from 1925 to 1939. Up to date, 377 cases of primary carcinoma of the tubes have been reported and published. Of these, 8 have remained without recidivation for more than five years. Among the 6 cases reported by the author there is 1 more which is considered cured. The cases are described in detail, and their symptomatology as well as diagnosis is discussed.

The cured case is that of a fifty-three-year-old woman who was laparotomized at an advanced stage of cachexia. Only the adnexa were removed, because the peritoneum was already affected and 12 liters of ascitic fluid were present. The patient received postoperative irradiation, and now, seven years after the operation is alive and well.

In case of hemorrhage the author recommends only limited use of castrating irradiation because there is a possibility that an undiagnosed carcinoma of the tube might be the cause of the illness. The diagnostic value of a sample scraping is given particular consideration and the importance of histological examination of all anatomical operative preparations is stressed.

In all cases of hysterectomy only the ovaries and not the tubes should be allowed to remain.

(KRAUL). HILDA H. WHEELER.

## EXTERNAL GENITALIA

**Cohn, A., Steer, A., and Adler, E. L.: Further Observations on Gonococcal Vulvovaginitis.** *Am. J. Syph., Gonor. & Ven. Dis.*, 1941, 25: 329.

In a study of gonococcal vaginitis, 1,070 examinations were made on 234 patients. Of these, 98.9 per cent were positive by culture and 67.1 per cent were positive by smear. This showed that cultures are superior to smears for diagnosis and determination of cure. Cultures are superior to smears also in rectal infections, which in this series were positive in 98.8 per cent by culture and in only 6.1 per cent by smear.

A study of 399 provocative tests failed to give conclusive results. Gonococcus vaccine, gonococcus filtrate, pilocarpine, aolan, silver nitrate, Lugol's solution, 50 per cent glucose, and 9 per cent sodium chloride all proved undependable.

Untreated cases undergo spontaneous cure within thirteen weeks in more than 50 per cent of patients. About one-fifth of these patients develop the carrier state, in which occasional positive cultures occur in the absence of clinical signs even after twenty-eight weeks of observation. However, all patients ultimately give negative cultures.

Sulfanilamide therapy resulted in cure in two-thirds of the hospitalized patients within two weeks of treatment. Sulfapyridine was followed promptly by negative cultures in all cases with recurrences in less than 10 per cent. Estrogenic substances brought about early clinical improvement, but it appeared that the course of the disease was little different from that in the controls.

Rectal infections were diagnosed by the findings of positive rectal cultures in 45 per cent of the patients. In none was there characteristic evidence of gonococcal proctitis clinically.

Contact with a source of infection either of a child or an adult, must be intimate before the disease can be transferred. CHARLES BARON, M.D.

# THE "PRESSURE THEORY" OF ECLAMPSIA

## A Collective Review with Selected Briefs

JOSEPH A. DAVIS, B.M., and LEE O. SNOOK, M.D.,
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ECLAMPSIA has with reason been called the "disease of theories." Among these many theories there is one which, it seems, has not been given adequate consideration. This idea, first clearly stated by King in 1887, is that the primary derangement in eclampsia is a mechanical one of pressure on the abdominal viscera consequent upon the filling of the abdominal cavity by the rapidly enlarging uterus. Either in whole or in part this concept appears in medical literature; it has never been disproved. Recent experimental work, especially that of Goldblatt (21), has added cogency to this old theory and necessitates its reappraisal.

The term "eclampsia" as used in this article includes syndromes referred to as low reserve kidney, pre-eclampsia, and eclampsia. The following list of selected briefs demonstrates that the "pressure theory" has been current for many years and has been advocated by men prominent in the annals of medicine. The essential components of the theory are clearly defined in these several briefs.

### SELECTED BRIEFS

1767. Morgagni (42) observed mechanical hindrance to the ureters during pregnancy.

1775. Alexander Hamilton (23) attributed convulsions in the advanced months of gestation to the irritation occasioned by distention of the uterine fibers, or by pressure of the uterus on contiguous viscera, which interrupted the natural functions of these parts and impeded the circulation of their fluids.

1827. Richard Bright (3) published his medical papers and called attention to the relation of vascular and renal disease.

1841. Rayer (52), who coined the term hydronephrosis, noticed that pregnancy and labor were complicated frequently by albuminuria.

1841. Cruveilhier (15) was the first to observe dilatation of the ureter in pregnancy. His observations were made post mortem on women who died following confinement or during the later months of pregnancy.

1843. Lever (34) reported the presence of albumin in the urine of 9 patients with puerperal convulsions.

1843. Robinson (53) showed that complete or partial tying off of the renal veins resulted in the appearance of albumin, blood, or both in the urine, and in enlargement of the kidneys.

1852. Meigs (40) stated that he rarely permitted his patients to lie on their backs during confinement because women who lie on their backs in labor, especially the first labor, are more liable to convulsions because of the greater pressure against the large vessels in the belly. This pressure, he said, could be relaxed, in the absence of pains, by the lateral decubitus.

1871. Halbertsma (22) implied that the discharge of urine through the ureters is hindered by pressure of the pregnant uterus or by catarrh of the ureters.

1877. Browne (4) reported a case of fibroid tumor of the uterus causing eclampsia.

1877. Cohnheim (10) noted cardiac hypertrophy in bilateral obstruction of the ureters due to a huge stone in the bladder.

1881. Lohlein (36) recognized the pressure theory of eclampsia and suggested the lateroventral decubitus in the treatment thereof.

1883. Kucher (42) stated that pregnant women suffering from morbus Brightii are more susceptible to eclampsia because the insufficiency of the diseased kidneys can be aggravated by alteration in the ureters by means of stretching, inflection, or infraction which the increasing or contracting uterus can produce.

1884. Halbertsma (22) stated that the albuminuria of pregnancy is observed chiefly when the sizes of the gravid uterus and the abdominal cavity are disproportionate.

1887. King (31) stated that disturbances in the renal circulation and renal function are produced mainly by pressure of the gravid uterus upon the abdominal aorta or its branches, upon the vena cava or its branches, or upon both or all of these. He recommended postural treatment of eclampsia.

1887. Cazeaux and Tarnier (18) mentioned the tense abdominal wall in primiparas as a factor in support of the pressure theory of eclampsia.

1894. Tibone (58) stated that increased intra-abdominal pressure may produce renal ischemia.

1897. Vaquez (60) and Nobecourt observed a rise in the blood pressure in eclampsia.

1901. Dorland (18), in listing the exciting causes of eclampsia, mentioned sudden pressure by the gravid uterus upon the kidneys or their excretory ducts, or upon the abdominal aorta and the inferior vena cava and their large branches.

1902. McReynolds (39), in his study of diastasis recti, attributed the condition to pressure effects of the enlarging pregnant uterus.

1903. Zangemeister (61) noted the variability of the albuminuria during labor.

1903. Hubert (26) believed that the albuminuria of eclampsia is caused by any obstruction to the circulation of blood in the kidneys, for instance, by compression of the vessels and ureters by the pregnant uterus.

1905. Katzenstein (29) produced mild experimental hypertension by incomplete occlusion of the renal arteries.

1905. Mynlieff (44) believed increased arterial tension is associated closely with the production of eclampsia. He regarded mechanical derangement of the kidney function, as by pressure on one or both ureters which produces an increased intrarenal tension because of the inelastic renal capsule, important in the pathogenesis of eclampsia.

1906. Vaquez (59) noted that during labor the blood pressure rises and may attain great heights.

1906. Cragin (14), in discussing pyelitis of pregnancy and the puerperium, regarded pressure on the ureters by the uterus as the cause.

1906. Shaw (55) assumed that the substance causing arteriospasm and producing cerebral disturbances without post-mortem lesions was the hypertensive substance "renin."

1907. Chirie and Mayer (9) observed eclamptic manifestations and rapid death of dogs in which the renal veins had been occluded ten minutes.

1908. Smith (56), in discussing pressure conditions within the abdomen, stated that the hydrostatic pressure at any point within the abdomen varies with the position of the body and the depth of the superimposed organs, and that during labor, contraction of the abdominal muscles causes an increase in the intra-abdominal pressure.

1909. McClintock and Longcope (38) noted a rise in the blood pressure when the superior mesenteric artery was compressed forty-three times in five minutes. They observed a rise in the blood pressure upon compression of the aorta.

1909. Schreiber (54), in a study on human subjects, observed that compression of the aorta at or above the renal level in suitable cases causes albuminuria.

1909, 1940. R. H. Paramore (47) repeatedly asserted that increased intra-abdominal pressure is the primary derangement in the hypertensive toxemias of pregnancy. He stated in 1932 that in eclampsia the underlying pathological process is almost peculiar to the latter months of pregnancy, an observation which in itself is sufficient to weaken irretrievably the idea that the disease is due to a poison specific of pregnancy. The great majority of women affected are primigravidas, women who up to pregnancy had been perfectly well, but in whom the abdominal wall never had been so stretched. For the rest, eclampsia occurs in cases of twin pregnancy, acute hydramnios, concealed accidental hemorrhage, and rapidly growing hydatid mole. All these conditions have one specific feature: a uterus enlarged more rapidly than normal, which produces the same physical effect as when the abdominal wall, *ab initio*, is good and the uterine enlargement average. As albuminuria is almost constant in pre-eclampsia and occurs early in that syndrome before malaise, edema, and headache, it is reasonable to believe that the preceding rise of the blood pressure is of renal origin.

1915. Hirst (25) recommended rupture of the membranes to reduce the blood pressure in eclampsia. He stated he had observed the pressure drop 100 points in a few minutes.

1915. Buschmann (6), in discussing his observations on unilateral renal involvement in eclampsia, suggested that the symptoms of eclampsia could be explained by the retention of substances which should be excreted. This diminished excretory power, he stated, is due primarily to venous stasis and to direct pressure of the gravid uterus on the kidneys.

1921. Gessner (20) noted a characteristic blood-pressure curve in eclampsia which was similar to the curve of the blood pressure in mechanical urinary obstruction.

1923. O'Conor (45) observed reduction of the blood pressure in prostatism upon relief of obstruction.

1924. Lee-Brown (33) in studying circulatory changes in progressive hydronephrosis concluded that the predominant change is an ischemic one which is due to increased intrarenal tension.

1926. Carson (7) observed the uterus resting upon the right ureter in post-mortem examinations of pregnant women.

1927. Crabtree (12) reported a case of unilateral stricture of the ureter with hydronephrosis in a patient who developed hypertensive toxemia

of pregnancy and continued with a post-partum hypertension. After nephrectomy the blood pressure returned to normal.

1927. Pedersen (50) produced experimental chronic hypertension in the rabbit by constriction of the renal veins with an aluminum band.

1927. Corwin and Herrick (11), on the basis of a clinical study, suggested that certain toxemias of pregnancy were not independent conditions but were related to other well known clinical syndromes, particularly nephritis and cardiovascular disease with hypertension.

1928. Kahn (28) found unilateral involvement of the urinary tract in 38 of 52 cases of hypertensive toxemia. He observed that as the renal involvement was improved by ureteral drainage, the hypertension subsided.

1929. Mylius (43) demonstrated spastic and tetanic vascular changes in the retinal vesseis in patients with eclampsia.

1931. Crabtree and Prather (13) stated that from their own observations and from the available literature they accepted as a working hypothesis that overdistention of the ureters and renal pelves exists in all pregnant women as a direct result of a tight-fitting uterus in an inelastic abdomen.

1932. Janney and Walker (27) demonstrated that the urinary output in pregnancy could be influenced by posture.

1932. Theobald (57) produced experimental hypertension by the introduction of a liter of paraffin into the abdominal cavity of dogs.

1933. Loesch (35) produced persistent hypertension by intermittent brief occlusion of the renal arteries, veins, and ureters.

1933. Menendez (41) produced hypertension by constriction of the renal veins.

1934. Pavlovsky (48) stated pregnancy may be considered a great predisposing cause of pyonephrosis because of mechanical pressure of the pregnant uterus.

1935. Ahltorp (1) concluded that symptoms such as tenderness, fatigue, pains in the abdomen or back, strong movements on the part of the fetus, and palpitation were due to compression of the inferior vena cava and upward displacement of the diaphragm by the pregnant uterus.

1936. Hayes (24) considered urinary back pressure as a cause of eclampsia and treated 20 cases by urinary drainage, with improvement in all.

1937. Peters, Lavietes, and Zimmerman (51), in a study of 320 cases of eclampsia, found that 13 per cent of the patients had suffered at some time from pyelonephritis. They concluded that pyelonephritis is one of the etiological factors of eclampsia.

1937. Kretschmer and Kanter (32) demonstrated that the ureters above the pelvic brim, as well as the renal pelves, were dilated in 100 per cent of pregnant women and that they returned to normal within twelve weeks after delivery.

1937. Kellar and Arnott (30), in a study of 33 patients dying of eclampsia, noted ischemia of the glomeruli as the most striking pathological feature.

1938. Matthews and Der Brucke (37), in a study of 200 pregnant women weighing 200 lbs. or more, found albuminuria in 35 per cent; edema, especially of the lower extremities, in 43.5 per cent; and a higher incidence of headache, dizziness, and gastro-intestinal disturbances than in women of lesser weight.

1938. Burwell (5) *et al.* demonstrated the chief alterations in the circulatory system of pregnant women to be: (1) an increased cardiac output; (2) a decrease in the arteriovenous oxygen difference; (3) a rise in the venous pressure in the lower extremities; (4) an increase in pulse pressure and pulse rate; and (5) an increase in blood volume. They concluded these changes are due, in the main, to two mechanisms: (1) an arteriovenous leak through the placenta and (2) an obstruction to venous return by the enlarged uterus.

1938. Dill and Erickson (17) produced eclamptic-like syndromes in pregnant dogs and rabbits by constriction of the renal artery. All of the dogs exhibited hypertension, hematuria, and albuminuria.

1939. Blalock, Levy, and Cressman (2) demonstrated that unilateral renal ischemia combined with intestinal ischemia resulted in a prolonged elevation of the arterial pressure in a high percentage of animals studied.

1939. Fishberg (19) stated that eclampsia is caused by diminution in the renal blood flow from pressure of the enlarged uterus on the ureters and renal veins, and occurs in women with an inherited predisposition to hypertension.

1939. Payne and Hodes (49) studied the effects of female hormones and of pregnancy upon the ureters of lower animals. Prolan, estrin, and progesterone injections did not produce ureteral dilatation in rabbits or dogs. Intravenous urographic examinations of pregnant rabbits and dogs did not reveal any ureteral dilatation.

1939. Dieckmann and Brown (16) recommended rest in bed, in the ventral decubitus, with pillows or a canvas frame to support the body and thus permit the uterus to fall away from the pelvic brim.

1939. Page and Ogden (46), in an analysis of the physiology of hypertension in eclampsia, concluded that neither the blood volume nor blood viscosity is of primary importance, but that hypertension is due to an increased peripheral resistance. This resistance is most probably functional, as suggested by the marked lability of the blood pressure, the absence of histological changes in the arterioles, and the rapid subsidence, in most instances, after delivery.

1939. Goldblatt, Kahn, and Hanzal (21) considered the possibility of their studies on renal ischemia and hypertension as being pertinent to the problem of eclampsia. They stated that as this condition occurs only at a time when the uterus is greatly enlarged, it is at least possible that the mass may press on the aorta or both renal vessels sufficiently to produce renal ischemia. They suggested postural treatment of eclampsia to relieve this pressure.

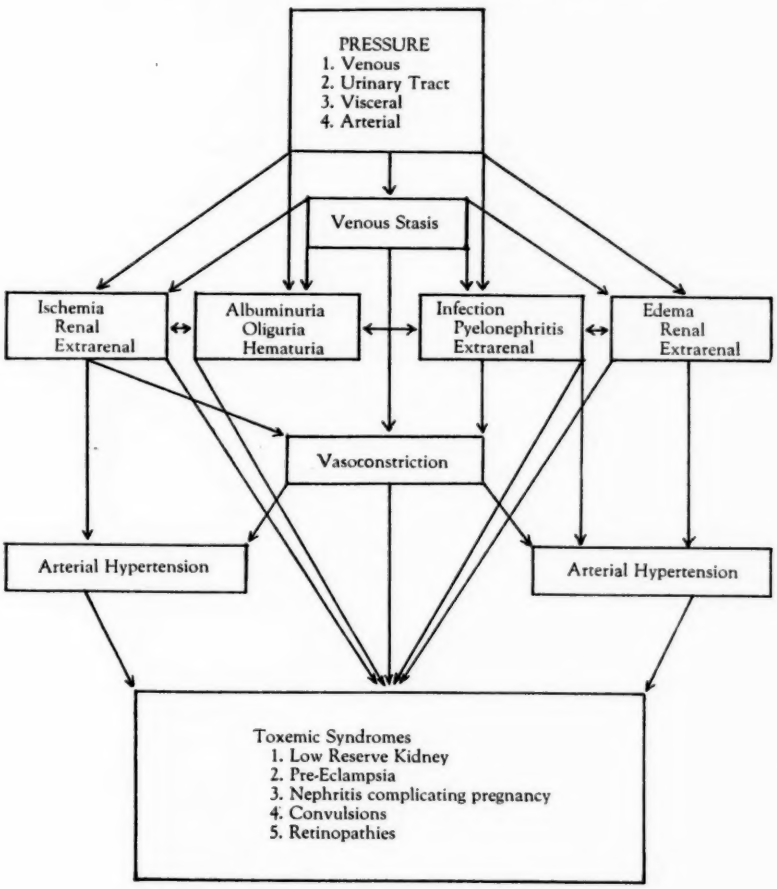


Fig. 1. This diagram is a representation of the various ideas expressed in the literature concerning the relation of pressure of the pregnant uterus to the pathogenesis of the toxemic syndromes of the late months of pregnancy.

DISCUSSION

From an anatomical standpoint, the renal veins and arteries, the inferior vena cava, the kidneys and urinary tract, and the aorta are in a position to be compromised between the pregnant uterus and the posterior abdominal wall. This is true particularly of the left renal vein which lies between the aorta behind and the superior mesenteric artery and the muscle of Treitz in front. In pregnancy, many investigators have demonstrated pressure of the enlarged uterus upon the right ureter and its relation to hydronephrosis and urinary-tract infection. The predominance of right ureteral involvement is attributed to the usual right obliquity of the pregnant uterus and the protection afforded by the sigmoid colon on the left. The lordosis of pregnancy would make these visceral structures more vulnerable to pressure. The analogous lordotic albuminuria in children is consistent with this idea. In quadrupeds, in which the hydrostatic pressure of the gravid uterus and of the intestines is exerted against the anterior abdominal wall, toxemia is said to be rare.

The abdominal cavity is of limited size and distensibility. The addition of the rapidly enlarging uterus to the contents of this cavity during pregnancy should produce a compression of the other viscera or a distention of the abdominal cavity. That the distention occurs is obvious. That a compression of the other viscera may occur is a possibility. That hypertensive toxemias are more common in primiparas, in whom the abdominal cavity and abdominal wall resists distention to a greater degree than in multiparas, is consistent with a pressure element being important in the genesis of these disorders. In addition, the toxemias are much more common in twin pregnancies and in polyhydramnios, in which conditions the increase in the uterine mass would be more likely to exert compression. The clinical observations that the hypertensive toxemias almost uniformly occur in the latter part of pregnancy, that they are relieved by delivery, and that they are improved by rest in bed and sedation are consistent with the theory of mechanical origin.

Ischemia of the kidneys, with resultant hypertension, has been produced experimentally and observed clinically to originate by several mechanisms. Some of these are:

1. Pressure on the renal artery and/or vein by various types of clamps.
2. Pressure on the kidney by the oncometer and celloidin pack.
3. Obstruction to the outflow of urine.
4. Urinary-tract infection.
5. Limitation of the blood flow to the kidney by the pressure of tumors.
6. Pressure on the aorta and inferior vena cava by various methods.

Of interest is the work of Dill and Erickson (17) who produced eclamptic-like syndromes in pregnant animals by constriction of the renal artery. Also of note is the reduction of an experimental hypertension by the release of constricted vessels or by the establishment of an improved blood supply to the kidney. Theoretically, all the above mechanisms could be duplicated by the pressure of the gravid uterus and an improved blood supply to the kidney would result through release of such pressure by delivery.

Thus, the old "pressure theory" as interpreted today would be that renal ischemia, produced by direct and indirect pressure of the gravid uterus, causes widespread arteriolar constriction from which follows the altered physiology characteristic of the hypertensive toxemias of the late months of pregnancy.

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# OBSTETRICS

## PREGNANCY AND ITS COMPLICATIONS

**Vignes, H.: Ovarian Rhythm During Pregnancy** (Le rythme ovarien pendant la grossesse). *Rev. franç. de gynéc. et d'obst.*, 1941, 36: 18.

Pregnancy suppresses menstruation and inhibits ovulation. However, certain facts have been observed that suggest that the ovary continues its cyclic activity in a latent fashion during pregnancy, and some authors have assumed that the cumulation of the periods absent during pregnancy is one of the factors in producing labor.

In his study of the question the author has found that when a woman habitually has long intermenstrual periods her pregnancy is longer than that of one who has the normal periods. In working this out in a large number of cases he has found that the length of pregnancy is practically that of ten intermenstrual periods. Menstruation returns as a rule about six weeks after delivery, that is, after about one and a half menstrual periods. Sometimes there is a slight discharge of lochia or blood about fifteen days after delivery which some obstetricians have interpreted as a late obstetrical hemorrhage. After abortion menstruation is reestablished very frequently within a period varying from one to one and a half menstrual periods. Spontaneous abortions generally begin at a time that would have corresponded, if menstruation had continued, to the interval between ovulation and menstruation, that is to say, to the lutein phase.

In an examination of 180 metrorrhagias occurring in the course of 1,344 pregnancies, the author found that in a small number of cases the hemorrhages had a periodicity that resembled that of menstruation. From these facts he thinks it reasonable to conclude that ovarian rhythm continues during pregnancy.

AUDREY G. MORGAN, M.D.

**Ballantyne, A. J.: Ocular Complications in Hyperemesis Gravidarum.** *J. Obst. & Gynaec. Brit. Emp.*, 1941, 48: 206.

Doubt is expressed by the author regarding the occurrence of purely neurotic cases of hyperemesis gravidarum, and some support is given to the view that a deficiency of Vitamin $B_1$ and perhaps of Vitamin C is an important factor in etiology.

It is shown that the current description of the ocular complications as hemorrhage and optic neuritis appearing along with a notable loss of vision when the patient is gravely ill, is incomplete and misleading. The earliest ocular disturbance is a retrobulbar optic neuritis associated with a central defect in the field and without visible ophthalmoscopic changes. This is succeeded by a visible edema of the optic nerve and later by a characteristic type of peripapillary retinal hemorrhage. The ultimate visual defect may amount to total or almost total blindness, which condition, however, is capable of complete recovery.

The profound visual loss and the form and situation of the hemorrhage, along with the absence of exudates and vessel changes, are important points in the differential diagnosis from ocular signs of cerebral tumor, subarachnoid hemorrhage, diabetes, and hyperpiesis. As the optic nerve and retina are essentially part of the brain, the optic neuritis and retinal hemorrhages are more closely related to the cerebral complications of hyperemesis gravidarum than to the associated peripheral neuritis.

It is recommended that in the treatment of persistent vomiting in pregnancy, the routine methods of rest, restoration of the fluid loss, and correction of constipation should be supplemented by the intramuscular administration of Vitamins $B_1$ and C. If these do not give a rapid response, and especially if polyneuritis, retrobulbar neuritis, papilledema, or retinal hemorrhages, occur, prompt termination of the pregnancy seems to be called for. The cessation of vomiting may be deceptive, and should not in itself be accepted as a sign of recovery without consideration of the patient's general state and the condition of the vision and fundi.

The serious significance of ocular signs should be recognized before the appearance of changes in the retina and optic nerve. By the time that retinal hemorrhages and optic neuritis have become manifest the patient's life is in jeopardy and treatment may be quite ineffective.

A description is given of 6 cases of hyperemesis gravidarum with ocular complications of varying degrees of severity, ranging from slight dimness of vision without ophthalmoscopic changes to total blindness with gross hemorrhages and optic neuritis, and it is recommended that even if an examination of the eyes cannot be carried out periodically in every case of pregnancy, any sign of defective vision should lead to a careful investigation of the visual acuity and field of vision as well as of the fundi. Early diagnosis of the ocular complications will help to reduce the frequency of one cause of maternal mortality.

CHARLES BARON, M.D.

**Wilson, J. St. G.: An Evaluation of the Treatment of Albuminuria of Pregnancy by the Water Balance Method, Assuming the Theory of Water Intoxication in Pregnancy.** *J. Obst. & Gynaec. Brit. Emp.*, 1941, 48: 161.

At the Walton Hospital, Liverpool, 905 patients suffering from all types of albuminuria except the hyperemesis of early pregnancy were treated in a period of five years. The present article evaluates the particulars of 859 of these who were delivered in the clinic. Among these cases were 8 maternal deaths, with 113 stillbirths and 45 neonatal deaths. There were 63 cases of eclampsia with 2 maternal deaths.

Every patient with albuminuria, whether slight or severe, attending the clinic is pressed to come into the hospital for investigation. The patient is put to bed and an ordinary mixed diet containing 20 oz. of free fluid is given. The balance is noted between the amount of fluid intake and the amount of urinary output, and if the output is about the equivalent of the fluid intake, the latter is maintained at that level for a time.

In a great majority of the cases this regime results in a lowering of the blood pressure, and in those which do not respond, an intravenous injection of magnesium sulfate and calcium gluconate is given until the blood pressure is within normal limits. If, however, the blood pressure does not appreciably diminish within from seven to ten days, the injections are discontinued, and in some cases a fall of blood pressure then occurs. Ten cubic centimeters of a 10 per cent solution of calcium gluconate and 10 c.cm. of a 20 per cent solution of magnesium sulfate are given.

If a water balance between the intake and output is not established, then induction of premature labor is usually recommended. Complete drainage of the cerebrospinal fluid in these severe and persistent cases of hyperpiesis is occasionally used as a preparation for the induction of abortion or premature labor to prevent eclampsism.

The routine treatment of eclampsia at the clinic is as follows:

1. Give ½ gr. of morphia, 10 c.cm. of 20 per cent magnesium sulfate solution, and 10 c.cm. of 10 per cent calcium gluconate solution intravenously. If the patient is conscious give 30 gr. of chloralhydrate by mouth, and repeat every four hours.

2. If there is a fit within the first half-hour following the injection, give ¼ gr. of morphia, and repeat the injection of the magnesium sulfate and calcium gluconate solutions.

3. Every time the patient has a fit repeat the dose of magnesium and calcium solutions, but if the fits follow one after another, stop them by the inhalation of a minimum quantity of chloroform.

4. If there is no fit within the first half-hour of the injection, give ¼ gr. of morphia at the end of the first hour.

5. In the presence of deep coma, or a complaint of severe headache, perform lumbar puncture, and drain the spinal canal dry.

6. In the presence of much cyanosis and edema of the lungs, consider venesection and the administration of atropine.

7. Catheterization is necessary in the presence of coma. Postpone rectal lavage until the fits are well controlled, and do not give chloral by rectum until that has been done.

8. If fits are induced by catheterization and colonic lavage, control them with a minimum inhalation of chloroform.

9. Cardiac asthma is to be treated with coramine.

10. Consider gastric lavage only in the presence of repeated vomiting when the patient is comatose.

11. If labor is in progress, ensure that the lie of the fetus is longitudinal. When the presenting part is on the pelvic floor, the second stage of labor may be completed with the forceps.

The nursing consists of keeping the room dark, absolute quiet, Sim's posture, especially if the patient is comatose, and having a gag ready for use. If fits are frequent keep the gag in the patient's mouth continuously. An oxygen cylinder should also be prepared.

The induction of abortion or labor was practised on account of symptoms in 92 patients; abdominal hysterectomy with sterilization was done in 1 patient. Cesarean section was performed in 8 cases during labor for some obstetrical indication.

CHARLES BARON, M.D.

**Orengo Díaz del Castillo, F.: Investigations on the Kidney of Pregnancy** (Investigaciones sobre el riñon del embarazo). *Rev. clín. española*, 1941, 2: 143.

In 1886 Leyden described the syndrome "kidney of pregnancy," which is more common in the second half of pregnancy and is frequently confused with other renal conditions. The author reviews some of the literature pertaining to renal changes during pregnancy and demonstrates the variety of conflicting views which have been recorded on this subject. He studied the problem experimentally with the aid of the Addis technique of making cell counts on the urinary sediment. He studied cases of normal pregnancy; pregnancy with edema, nephritis, preeclampsia; and cases during the puerperium. His results are tabulated and record the amount of urine, density, albumin, erythrocytes, leucocytes, and hyaline, granular, and epithelial casts. He noted that the kidney of pregnancy has a diminished capacity for concentrating the urine, which defect disappears during the puerperium.

These studies indicate that in the kidney of pregnancy there is a disturbance of the glomeruli as well as of the tubules; however, the glomerular component is more prominent. This agrees with the fact that circulatory disturbances are more prominent in pregnancy. The urinary changes between normality and eclampsia are only a matter of degree. These changes are predominantly vascular in nature. The correct term for the syndrome occurring in pregnancy is "the kidney of pregnancy." This is neither a nephritis nor a nephrosis. It is merely a result of the colloidal, vegetative, and hormonal changes of pregnancy. Already existing nephritis and nephrosis are aggravated by pregnancy. In pre-eclampsia and eclampsia the glomerular component becomes accentuated and is associated with a vasoconstrictor crisis. During the puerperium the kidney returns to normal. Whatever harmful influence gestation has on the kidneys occurs in the last months of pregnancy. No more extensive classification of renal conditions in pregnancy is required than the following: (1) the kidney of pregnancy; and (2) diseases of the kidney in the pregnant woman.

JACOB E. KLEIN, M.D.

**Flaemrich, E.: Shotgun Wound of the Pregnant Uterus** (Schussverletzung des schwangeren Uterus). *Zentralbl. f. Gynaek.*, 1941, p. 25.

The case described is that of a girl fifteen years of age, in late pregnancy, who had shot herself in the abdomen with a 7 mm. Flaubert bullet. The aperture of entry was located in the right upper region of the abdomen, while the aperture of exit could not be located. Fluoroscopy disclosed the bullet to be lodged in the child's skull. The dead child was removed by means of a laparotomy and section. The bullet had penetrated the anterior wall of the uterus and the placenta which was attached at this site; none of the other organs of the abdomen disclosed injury. Following careful suture of the incision and suturing-over and peritonization of the bullet hole, the girl recovered without complications.

The child, which weighed 3,050 grams, had received a perforating projectile wound through the left shoulder, and then the missile had entered the left angle of the lower jaw to lodge in the middle fossa of the skull.

The treatment of gunshot wound of the gravid uterus should consist in the earliest possible laparotomy; if the uterus is not emptied by section, a spontaneous extrusion of the products of conception occurs sooner or later in most cases.

(K. Heising). John W. Brennan, M.D.

## LABOR AND ITS COMPLICATIONS

**Durst, F.: The Modern Therapy of Labor in the Presence of Contracted Pelvis** (Moderne Therapie der Geburt bei engem Becken). Liječn Vjesn., 1940, 62: 421.

In the obstetrical material collected in the clinic of Zagreb, contracted pelvis with a conjugata vera of 9 cm. or less occurred 389 times among 11,271 births (3.45 per cent) during the years from 1932 to 1939.

The management of labor in contracted pelvis in the past was most frequently based on prophylactic measures (induction of early labor, or the use of podalic version), and upon the classic cesarean section; still later, on symphysiotomy and pubotomy. The latter two methods have persisted until the present, although only within very narrow margins of indication; in the Zagreb clinic symphysiotomy was performed only 40 times from 1932 to 1939, in cases of moderate disproportion between the head and pelvis. However, this procedure was never used in primiparas. The maternal mortality was zero and the fetal mortality was 5 per cent. The classical cesarean section has been completely replaced by the cervical cesarean section. The author discusses in detail the indications and conditions under which, according to the cesarean rules, the cesarean section may and should be carried out in cases of contracted pelvis, and also when this procedure should not be taken into consideration.

In the Zagreb clinic this procedure was carried out 101 times in cases of contracted pelvis during the course of eight years: in 7 cases the Doerfler procedure with eventration was used; in 85 cases a cervical transverse incision, without eventration (1 fatality due to peritonitis); in 1 case classic cesarean section was used; in 3 cases the extraperitoneal approach; in 4 cases a cervicocorporal cesarean incision was made according to Franz; and in 1 case a Poro operation was done and death resulted from hemorrhage. The maternal mortality, therefore, amounted to 2 per cent, of which 1 per cent was due to infection. The amniotic sac in 25 cases ruptured five hours before the therapeutic procedure; in 12 cases, ten hours before; in 8 cases, fifteen hours before; and in 3 cases, twenty hours before; in 11 cases rupture of the sac occurred more than twenty hours before. The fetal mortality amounted to 1 per cent. Symphysiotomy was performed 24 times. The total of both procedures, therefore, amounted to 125 of 389 cases, or 32 per cent. In certain cases in which the mother refused consent for cesarean section, craniotomy had to be done.

The author, furthermore, describes the technique and results of roentgenological pelvic mensuration. He joins in the opinion of other authors that it is better to wait with roentgenological examination until a few hours after the rupture of the amniotic sac, when the head lies directly on the pelvic entrance and the pains have already persisted for several hours. In the event that at this time, either by external or internal examination, the prognosis is not clear, a roentgenogram should be taken. This is done most advantageously (in profile) because it is during this time that the cephalopelvic disproportions are best visible. If at this time, when the head is already shaped, the latter still protrudes beyond the inner margin of the symphysis, there is indication for cesarean section. In cases of pelvis with a conjugata vera of 8 cm. or less, the author employs x-ray examination at the termination of pregnancy without further ado.

In conclusion, the author emphasizes the importance of careful examination of the pregnant patient, as the result of which the contracted pelvis can be recognized in good time and the patient admitted to the hospital.

(Vilma Janisch-Rašković). Harry A. Salzmann, M.D.

## NEWBORN

**Henderson, H., Foster, E. B., and Eno, L. S.: The Relative Effect of Analgesia and Anesthesia in the Production of Asphyxia Neonatorum.** *Am. J. Obst. & Gynec.*, 1941, 41: 596.

Ninety and six-tenths per cent of babies born when the mother is under the influence of analgesia show no evidence of clinical asphyxia. Causes other than the use of analgesia or anesthesia are found in two-thirds of the infants that are clinically asphyxiated and may be present in others. General anesthesia definitely decreases the respiratory response of the newborn. The percentage of asphyxiated babies of

amnesic mothers delivered under local anesthesia is comparable to the percentage expected when unnarcotized mothers are delivered under light ether or chloroform anesthesia.

When properly supervised and in the hands of those familiar with their use, analgesics *per se* do not increase the incidence of asphyxia. Neither anesthesia nor analgesia, properly controlled, need be a factor in the production of stillbirths. In the majority of cases asphyxia neonatorum is due to interference with the transfer of oxygen from the maternal blood to that of the fetus. The use of local anesthesia whenever possible will reduce the natural hazard of birth. EDWARD L. CORNELL, M.D.

**Huber, C. P., and Shrader, J. C.: Blood Prothrombin Levels in the Newborn.** *Am. J. Obst. & Gynec.*, 1941, 41: 566.

Repeated observations of the blood prothrombin level were made on 506 infants. There were, in addition, 15 stillborn infants and 9 infants who died during the neonatal period. This represents a gross fetal mortality of 4.5 per cent. Of the 9 infants who died during the neonatal period, 2 received Vitamin K subsequent to delivery, 4 were born of mothers who received Vitamin K during labor, and 3 were in the control group. In 2 of these 9 infants a clinical diagnosis of cerebral hemorrhage was confirmed at necropsy. The mothers of each of these infants had received Vitamin K during labor.

In the first case a hydrocephalic infant with a lumbar spina bifida was delivered by low forceps application and extraction. Death occurred forty-two hours after birth, following frequent attacks of cyanosis, impaired respiratory activity, and convulsive movements. Necropsy showed a fracture of the frontal bone and extensive intracranial hemorrhage. The second infant was delivered naturally following an episiotomy after a forty-hour labor. Respirations were spontaneous and the infant appeared in good condition. A cyanotic attack with difficult respiration occurred twenty-two hours after delivery, and the infant died at thirty-nine hours. The prothrombin determination following the initial evidence of cerebral irritation was 50 per cent of normal. Two milligrams of the Vitamin K preparation were given by gavage nine hours before death. Necropsy showed an intracranial hemorrhage as the cause of death. In neither of these infants are we justified in assuming that a low prothrombin level in the blood was a factor in the intracranial hemorrhage. In the first case there was obvious trauma, and in the second infant the clotting activity was not significantly impaired.

Normal infants show a physiological decrease in prothrombin activity in the blood, which reaches a maximum during the third day of life. A spontaneous return to a normal level occurs during the first week of life.

A wide variation is noted in individual infants in the depth of this decrease and in the rapidity of the return to normal levels. This decrease in clotting activity can be prevented by the administration of Vitamin K preparation to the infants during the early hours of the neonatal period or to the mother during the course of labor.

A potential relationship exists between the level of prothrombin activity in the blood and the severity of intracranial hemorrhagic tendencies in the newborn infants.

Two methyl-1, 4 naphthoquinone exhibits an active Vitamin K effect. EDWARD L. CORNELL, M.D.

# GENITO-URINARY SURGERY

## ADRENAL, KIDNEY, AND URETER

**Katz, F., and Mainzer, F.: Successful Grafting of the Adrenal Gland in a Case of Addison's Disease.** *Brit. M. J.*, 1941, 1: 617.

In a severe case of Addison's disease the adrenal gland of a patient belonging to the same blood group, who had just died, was grafted into the abdominal musculature.

The functional results, as observed over a period of fifteen months after operation, are excellent. A state of compensation has been produced so long as the patient lives under normal conditions. Only after special exertion or during a transitory infection, with added demand on the adrenal, are slight signs of insufficiency noted. JOHN A. LOEF, M.D.

**Bergman, R. T.: Vaginal Ureterolithotomy.** *J. Urol.*, 1941, 45: 176.

A brief historical survey of vaginal ureterolithotomy is made and attention is called to the vaginal surgical approach in the female for impacted calculi in the lower ureter. The technique used by the author is presented; it offers the possibility of successfully retrieving a stone from a ureter. In a few of his cases in which the stone was not impacted and slipped up the ureter, a Johnson basket dislodger was successfully used to retrieve the stone. Previous manipulative attempts with the same instrument cystoscopically had met with failure, and the author believes this is a valuable adjunct in the surgical procedure. A short résumé of the postoperative treatment and the complications is given.

D. E. MURRAY, M.D.

## BLADDER, URETHRA, AND PENIS

**Wheeler, W. K.: Periostitis Pubes Following Suprapubic Cystostomy.** *J. Urol.*, 1941, 45: 467.

Periostitis pubes is a definite clinical entity which simulates acute bone atrophy rather than periostitis and presents the following characteristics:

1. It develops only after suprapubic operation when the bladder is opened. It appears any time after two weeks.

2. There is extreme pain in the pelvis when the patient attempts to move. Tenderness is present over the affected area; i.e., the pubis and ischium.

3. Adductor spasm of the thighs is always present. There is inability to spread the legs or to walk.

4. The x-rays disclose a mottled rarefaction of the pubis and rami of the ischium. This becomes diagnostic as the disease advances.

5. Pieces of periosteum and bone are separated from the rami in the softening or atrophic stage at the muscle-tendon insertions.

6. It is a self-limited disease which requires no surgical intervention. JOHN A. LOEF, M.D.

**Parmenter, F. J.: Diverticulum of the Female Urethra.** *J. Urol.*, 1941, 45: 479.

Eight cases of diverticulum of the female urethra are reported and discussed under the headings which follow:

*Etiology.* There is no general agreement as to whether the origin of urethral diverticula is congenital or acquired. The probability is that both views are correct. Johnson suggests that an acquired diverticulum may be due to (1) trauma at childbirth, (2) infection of the urethral glands with sealing off of the opening to the urethra, the formation of an abscess, and re-establishment of communication, (3) instrumentation of the urethra, especially deep fulguration, (4) urethral stricture, and (5) urethral stone. He believes that a congenital diverticulum may be due to (1) Gartner's duct, (2) cysts formed from faulty union of the prima folds, (3) cell nests, (4) the wolffian duct, and (5) vaginal cysts.

*Symptoms.* Frequency, urgency and difficulty, a lump in the vagina, pain upon walking or upon coitus, and intermittent discharge from the urethra, especially when douching, are the prominent symptoms. Some patients discovered that they could obtain relief by inserting the finger in the vagina and emptying the diverticulum.

*Diagnosis.* The patient will have urinary symptoms. She may or may not complain of a mass in the vagina presenting at the vulva. The diverticulum, which feels soft and fluctuating, can easily be recognized on vaginal palpation. If pressure is made upon it with the labia separated, pus or urine, or both, will be seen to drip from the meatus with disappearance of the mass. Cysto-urethroscopy will demonstrate one or more openings, usually on the floor of the urethra or slightly above on the lateral walls. The opening of the diverticulum is usually just in front of the sphincter. A small ureteral catheter can be passed and will coil up in the diverticulum and be readily seen by means of x-rays, following which diodrast can be injected through the catheter and a diverticulogram made.

*Treatment.* Treatment may be conservative or radical, though the latter is undoubtedly the method of choice except under unusual circumstances. The technique used is radical removal of the sac, which is ligated and amputated at the urethral junction. The stump is inverted up into the urethra by two layers of interrupted No. oo chromic catgut sutures. The mucous membrane is closed with No. 1 chromic catgut suture. Silk is not used because it may become a foreign body, as it did in one of the author's cases of vesicovaginal fistula. An indwelling catheter, which must be kept draining, is left in place for ten days. The vagina is also lightly packed with gauze soaked in an approved antiseptic, which is changed daily or every other day as indicated. One of the usual urinary antiseptics, which

has been given internally a few days prior to the operation, is continued. JOHN A. LOEF, M.D.

## GENITAL ORGANS

**Trabucco, A.: New Ideas in Regard to the Pathogenesis of Adenoma of the Prostate** (Nuevos conceptos sobre la patogenia del adenoma prostático). *Rev. argent. de urol.*, 1940, 9: 377.

The author discusses the various theories that have been held at different times and by different authors in regard to the pathogenesis of adenoma of the prostate gland. He considers particularly the theory that this form of tumor does not originate in the gland itself but in the so-called periurethral glands. He believes that these glands are periurethral only in location, and that in reality they are made up of true prostatic tissue; their gland function is latent but it may be developed at various periods of life by stimuli of endocrine origin.

An adenoma may develop in any part of the prostate gland, or in these so-called periurethral glands in the lower wall of the retromontanal urethra, which are really true latent prostatic glands. The adenoma tends to develop toward the bladder and urethra because it is only in that direction that resistance is not offered by the surrounding tissues. For that reason the majority of the adenomas that develop so as to become true tumors are the prespermatic ones.

There is a capsule around the adenoma formed by the true gland tissue which is compressed and pushed aside. This capsule, however, includes not only the true gland tissue but also other small adenomatous nodules which have been overgrown and pushed aside by the dominant one which develops into a true tumor.

Histological pictures of a number of adenomas of the prostate are given which tend to support the author's theory. AUDREY G. MORGAN, M.D.

**Dorman, H. N.: Transurethral Prostatic Resection.** *J. Urol.*, 1941, 45: 411.

Prostatic resection is a satisfactory way to treat many types of prostatic obstruction. In the author's series, 84 per cent of all obstructing glands were treated by resection.

Prostatic resection can be performed by the average well trained urologist who is willing to apply himself diligently until the exacting details of resection are mastered. It is the simplest way to relieve obstructive symptoms in the more debilitated men and those suffering with advanced carcinoma.

All urologists cannot become expert resectionists. However, our younger urologists, and those being trained at the present time, should avail themselves of every opportunity to become proficient in the technique of resection.

The importance of adequate equipment, thorough preparation of each patient, intelligent nursing care, and meticulous attention to the details of resection are stressed. JOHN A. LOEF, M.D.

**Gutierrez, R.: Perineal Prostatotomy and Prostatectomy for the Removal of Prostatic Calculi.** *Ann. Surg.*, 1941, 113: 579.

Prostatic calculi are more frequently observed than one might believe from a study of the medical literature. In fact, they are rather a common finding, clinically, operatively, and, especially, at autopsy.

Etiologically, prostatic calculi may be classified in three groups: endogenous—when they are formed in the substance of the gland; exogenous—when, coming from the upper urinary tract, they become deeply imbedded within the region of the prostatic urethra; and mixed or endo-exogenous—when, originating in the prostate, they come in contact with the exogenous elements of the urine which accelerate their growth so that they become in reality prostatourinary calculi. The intimate interrelationship of these three types of prostatolithiasis may frequently be observed in the same individual.

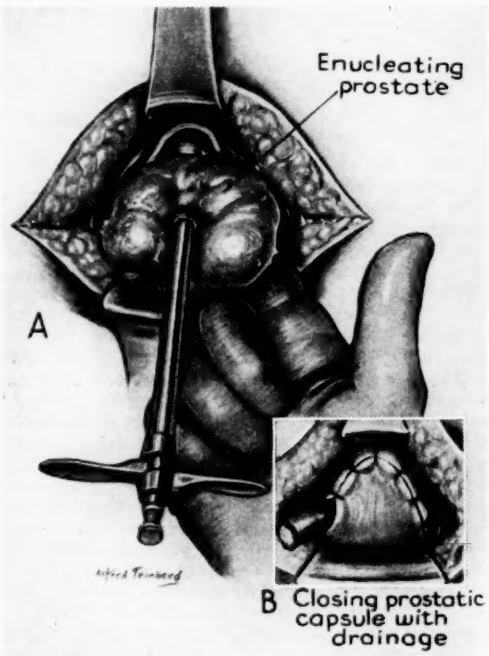


Fig. 1. Drawing to illustrate the operative technique of perineal prostatectomy, particularly when prostatolithiasis is associated with adenomatous hypertrophy. (a) After the usual perineal surgical exposure, the capsule is opened and a retractor inserted through the prostatic urethra into the bladder, without opening the membranous urethra. The nucleation of the adenoma is then accomplished with the index finger, following the line of cleavage, thus removing the entire organ in one piece. (b) The capsule is closed by interrupted sutures, leaving a cigaret drain in one angle of the wound.

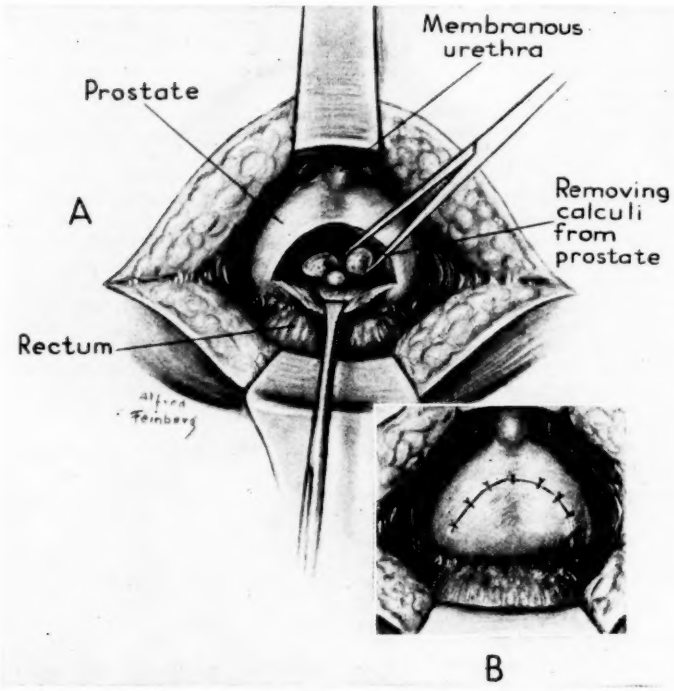


Fig. 2. Operative technique of perineal prostatolithotomy: (a) The perineal surgical exposure of the prostate, showing a transverse incision on the surface of the gland for the purpose of removing all the calculi that may be present. (b) Method of closure of capsule by interrupted sutures. (Courtesy of J. B. Lippincott Co.)

The most commonly accepted theory of the mode of formation of the minute intraprostatic calculi is that the corpora amylacea in the acini of the gland become surrounded with calcareous deposits and act as nuclei for the development of the true prostatic calculi within the tubules of the prostate.

For purposes of treatment, irrespective of their origin, all classes of prostatic stones, when producing symptoms, demand surgery for their removal.

Asymptomatic stones are not surgical and demand no treatment, but patients in whom they are accidentally discovered should be kept under close observation, since they are harboring a latent infection which may lead to destruction of the parenchyma of the gland, produce obstruction and impair function, cause abscess and chronic diverticulitis within the gland, and even, in advanced cases, cause complete calcification.

The association of prostatic calculi with parenchymal prostatitis and adenomatous hypertrophy is a common occurrence. Most of the cases in this series have shown evidence of chronic or acute prostatitis, and in 8 patients adenomatous prostatic hypertrophy was present.

The symptomatology of this disease is insidious. Some cases are asymptomatic, but frequently the patient is suffering from minor urinary, rectal, or genital symptoms of an indefinite nature. All the patients in this series had urinary symptoms, ranging from mild frequency and dysuria to total hematuria and complete retention of the urine, with all the characteristic symptoms observed as a rule in prostatic obstruction. A few patients complained of urethral stricture. In other instances arthritis or generalized sepsis of long standing was present as the result of prostatolithiasis.

The diagnosis can often be made by rectal palpation of the gland, which in advanced cases elicits a characteristic crepitation and reveals the presence of hard nodules. These findings can be confirmed by the plain roentgenogram and by urethrocystography.

Cystoscopic examination is helpful in establishing an accurate diagnosis, particularly when there is prostatic hypertrophy or a characteristic bullous edema at the floor of the bladder neck and in the region of the prostatic urethra. It will also serve to determine the best type of operative procedure in each individual case.

The diagnosis was made by rectal palpation in 67 per cent of the cases, and in 100 per cent of the cases submitted to roentgenologic examination. No urographic examination should be considered complete unless the region of the prostate is examined, since the discovery of clinically unsuspected prostatic calculi is common.

Of 29 cases herewith reported, 17 came to operation, and, of these, 13 were cured and 4 showed improvement. Of 12 cases not operated upon but treated medically and urologically, 5 showed improvement, and 7 showed none.

The paramount surgical consideration is not merely the removal of all prostatic calculi, but also the maintenance of open drainage, in order to relieve the infection and restore good function, if permanent cure is to be obtained.

The best surgical treatment, when operative intervention is indicated, appears to be perineal prostatolithotomy. When the condition of prostatolithiasis is associated with adenomatous prostatic hypertrophy, perineal prostatectomy assures a permanent cure.

Since the stones, as a rule, are multiple and lie in closed infected pockets in cases complicated with prostatitis, or lie near the capsule in cases of adenomatous prostatic hypertrophy, it appears that endoscopic prostatic resection is not applicable in the majority of these cases. D. E. MURRAY, M.D.

**Mayer, R.: Prophylactic and Curative Treatment of Metastases of Malignant Tumors of the Testicle** (El tratamiento profiláctico y curativo de las metastasis de los tumores malignos del testículo). *Rev. méd. d. Rosario,* 1941, 31: 105.

The author describes 9 cases of metastases of malignant tumors of the testicle treated by roentgen irradiation between July, 1934, and October, 1940. The results were so good that he urges collaboration between clinician, surgeon, and roentgenologist in bringing these patients for treatment as early as possible and in the application of roentgen treatment for the prophylaxis rather than the cure of metastases.

In any case of tumor of the testicle the organ and the tumor should be removed. Syphilis, tuberculosis, and other conditions which cause enlargement of the testicle can be excluded by suitable examinations. In 1 of his cases the patient refused resection of the testicle. In this case he used a tension of 200 kv., 50 cm. focal distance, a filter of 2 mm. of copper and 3 mm. of aluminum and gave a dose of 3,500 roentgens in ten days. This caused a violent radioepidermitis which healed in twenty-five days. The treatment was given in July, 1939, and in October, 1940, the patient was still well.

The dosage and technique depend on the localization of the metastases. Abdominal metastases are irradiated from 4 anterior fields with their vertices at the umbilicus; generally a dose of 1,600 roentgens measured in air brings about total disappearance of the gland metastases. The dose per field and per day is very important. Too large a dose causes vomiting, anemia, loss of appetite, and insomnia.

Generally only one field was irradiated per day and a dose of from 160 to 400 roentgens given. A blood count should be made every week and even more frequently if possible.

Mediastinal metastases are much more sensitive to irradiation than metastases in the lungs. For mediastinal metastases the author recommends a dose of from 200 to 250 roentgens per field per day; large masses of glands can be made to disappear with a total dose of 3,500 roentgens. However, in the lung even doses of from 150 to 200 roentgens per day may have serious effects on the general health. The only death in the author's series was that of a man with lung metastases whom he irradiated with a dose of only 125 roentgens per day per field over two fields, one anterior and one posterior. The man was in serious general condition and the blood count was not followed up with sufficient care. In such cases very moderate doses should be used even though this prolongs the treatment greatly.

AUDREY G. MORGAN, M.D.

## MISCELLANEOUS

**Rakovec, S.: Urogenital Tuberculosis** (Die Urogenitaltuberkulose). *Zdravot. věstník,* 1940, 12: 206.

During the last few years the number of nephrectomies for urogenital tuberculosis has been increasing because of the better diagnostic methods, and this has resulted in a lower mortality for this disease. Socially it is of significance that urogenital tuberculosis attacks people between the ages of twenty-five and thirty-five. It is a secondary tuberculosis, the primary focus usually being in the lung.

In all urological complaints one must think of tuberculosis. In the uropoietic system it is almost the rule that the kidney is affected primarily. It is generally recognized today that involvement of the kidney is by the hematogenous route. The process in the kidney takes place similarly to that in other organs: (1) tissue injury, (2) exudation, and (3) proliferation. The first phase usually takes place in the sensitive epithelium of the glomeruli. For the second phase, exudation, a wide field is open. The formation of cavities is caused by proteolysis. The author classifies the condition into two forms, the miliary and the chronic cavernous form. The second form may lead to generalized tuberculosis of the urogenital tract. The extension may occur by three different ways, again hematologically, by way of the lymph stream, or by way of the urinary stream. Bacilli, leucocytes, or red cells may be absent in the urine, but in spite of the negative findings the urine may contain albumin and be of diagnostic significance. Disturbed kidney function and a defect appearing in the pyelogram are further diagnostic symptoms. With ureteral tuberculosis there is also usually tuberculous peri-ureteritis. In the diagnosis of bladder tuberculosis shrinkage of the bladder with decreased capacity is important. The so important

early diagnosis of kidney tuberculosis is made difficult because of the lack of early symptoms. In advanced cases we find pollakiuria and terminal micturition pain. In 5 per cent of the cases there is a hematuria without pain, and in another 5 per cent there are typical colic attacks. Every case of cystitis which lasts longer than six weeks should be suspected of tuberculosis. The same is true of hematuria of undetermined origin, microscopic hematurias with pyuria, and pollakiuria with normal urine findings.

Thirty-three per cent of all diseases of the urogenital tract are upon a tuberculous basis. The urine should be examined for tubercle bacilli microscopically, by culture, and by animal injection. In catheterization of the ureter for tubercle bacilli the ureteral catheter should be introduced only 10 cm. so as not to drag organisms from one kidney into the other. In examination of the divided urine, leucocytosis on only one side points to tuberculosis. Retrograde pyelography is more definite in diagnosis than is the intravenous type. The most exact diagnosis is always made by animal injection.

Nephrectomy which removes the primary focus is the treatment of choice. The prognosis of the surgical treatment is variable and depends upon the duration of the disease. In most cases the patient reaches the surgeon too late. With early operation 80 per cent of the cases may be cured; later only 60 per cent. One may speak of healing if within three years no bacilli and leucocytes appear in the urine. Bilateral tuberculosis of the urinary tract is rare; it occurs in from only 10 to 12 per cent of the cases. In these cases operation is, of course, contraindicated.

In conclusion the author discusses epididymal tuberculosis and states that in all instances of this condition one must think of kidney tuberculosis. Epididymectomy results in cure in 90 per cent of the cases. Tuberculosis of the prostate and seminal vesicles is treated conservatively.

(Gregora). Leo A. Juhnke, M.D.

**Cifuentes Delatte, L.: The Male Sex Hormones** (Sobre las hormonas sexuales masculinas). *Rev. clín. española*, 1941, 2: 1.

The author first reviews the literature on the endocrine activities of the sex glands, beginning with the work of Berthold (1849), and Brown-Séquard, then down to modern times with the synthesis of testosterone by Butenandt. He then describes and classifies the natural androgenous substances. Among these he includes testosterone (isolated from the testis of the bull); androsterone (from male urine); dehydro-androsterone (from male urine); progesterone (a bi-sexual hormone from the corpus luteum); adrenosterone (from the adrenal cortex); pregnanetriol (from female urine and having an adrenogenital masculinizing effect); desoxycorticosterone (from the adrenal cortex); and a number of less well known substances. The chemical nucleus of these hormones is a sterol analogous to cholesterin, the only differences being in the side-chains. These substances are tested biologically by their effect on the rooster's comb, prostate, and seminal vesicles. The biological unit is the effect of 0.1 mgm. of crystalline androsterone on the rooster's comb which is called 1 international unit. The chemical testing of these substances is based on the colorimetric reactions of Zimmermann in which varying color reactions are induced by the chromogenic ketone group. There seems to be a close correlation between the chemical tests of Zimmermann and the biological tests.

In discussing the metabolism of testosterone the author indicates its hypothetical formation from cholesterol as follows: cholesterol-transdehydro-androsterone-androstenediol-testosterone. The blood of the normal adult male contains small quantities of testosterone which are eliminated in the urine in the form of androsterone. In the absence of the testes small amounts of androgens are still eliminated in the urine. Thus Hoskins and Webster found in a study of 2 eunuchs that 6 international units of androgens were eliminated daily. However, in the absence of testes the relation of androsterone to dehydro-androsterone was 4:1 as compared to the ratio of 1 to 1 in the normal male. The source of these androgens in the castrated individual is as yet controversial. Experiments have indicated that some testosterone is destroyed in the liver and kidneys, although the liver does most of this destructive work in man. Almost all of these substances are inactive by mouth. Zondek has demonstrated that the estrogens are inactivated if incubated *in vitro* with liver pulp. Glass and his collaborators have observed gynecomastia with high values of urinary estrogens in 8 men suffering from cirrhosis of the liver. There is still much to be learned concerning the relation between the liver and the sex hormones. Day has reported that there are liposoluble X-substances in the testes which re-enforce the action of testosterone.

There is no complete absolute sex specificity of the gonads. In unusual circumstances the ovaries may produce androgenic substances. Hill demonstrated this experimentally by transplanting the ovaries of rats out of the abdominal cavity; when the ovaries are thus exposed to a lower temperature they form androgenic substances which cause hypertrophy of the clitoris and other symptoms of virilization. Hill notes a great similarity between the androgens so produced by the ovaries and testosterone.

The adrenals have an androgenic activity apart from the cortical hormone (desoxycorticosterone), adrenosterone and 17-B-hydroxyprogesterone. In castrated rats the adrenal gland has been shown to assume a masculinizing function. Adrenalectomized rats which have also been castrated do not live as long those which retain their adrenal glands. This compensatory action of these glands has led to the formation of compensatory adenomas of the adrenal cortex, according to Spiegel. From clinical experience it has been known that cortical tumors in the

adrenal gland exert a virilizing influence in the female.

*The effect of the pituitary gland on masculine gonads.* In general the urinary gonadotropic hormones of pregnancy are identical with the pituitary hormones. The pituitary gonadotropic hormones cause an increase in weight of the testes in experimental animals and also stimulate spermatogenesis. The author discusses some of the biochemical differences in detail.

*The action of androgens on masculine gonads.* Testosterone overcomes the atrophy of the prostate, seminal vesicles, and vas deferens resulting from castration. However, there have been reports that testosterone may also cause a loss in weight of the testes and may inhibit spermatogenesis. According to Cutuly and Cutuly, only one phase of spermatogenesis, the reduction—division phase, is under the influence of the gonadotropic hormones. Furthermore, in a series of biological experiments on rats, frogs, salamanders, fishes, and birds, testosterone was shown to exert a masculinizing influence on the female and even on the embryo. There is no hormone known that is purely unisexual in its effects. Butenandt noticed an estrogenic effect of testosterone on the young female rat. In reptiles testosterone has a greater estrogenic effect than in mammals. The synthetic hormones also have this multiple action. Among these, ethenyltestosterone has estrogenic and androgenic action as well as progesterone activity. Furthermore, testosterone possesses a trophic action on the kidneys. Large doses may cause pathological changes in the kidneys; thus, Paschkiss and Fels observed urolithiasis in 14 of 46 rats which were given large doses of testosterone propionate.

As to the mode of administration of testosterone, it is usually given subcutaneously or intramuscularly or by the subcutaneous implantation of the crystalline tablets. The usual dose is from 10 to 25 mgm. 2 or 3 times a week. In a eunuch of thirty-eight years the minimal effective dose was 40 mgm. of testosterone propionate per week, which was given by subcutaneous injection.

As concerns the danger of cancer formation, this is less with androgens than with estrogens. Thus far there have been no clinical reports as to the occurrence of malignancies after the administration of androgens.

The clinical indications for male sex hormones are deficient testicular function and need for stimulation of the secondary sex characteristics. In eunuchism and absence of the gonads only androgenic substances are effective, since the gonadotropic substances of the hypophysis act only by stimulating the tissues of the testes. In cases of hypogonadism, McCullagh and McGurl have obtained good effects on the secondary sex characteristics, libido, and sex function by the use of testosterone. In cryptorchidism testosterone may be used when there are symptoms of hypogonadism. Thus McCullagh successfully treated 3 cases of cryptorchidism which had not responded to treatment with extract from the anterior lobe of the hypophysis.

In gynecology good results have been obtained by the use of testosterone propionate in the treatment of metrorrhagia and menorrhagia. Male sex hormone has also been used in the treatment of chronic mastitis, dysmenorrhea, and the postmenopausal disturbances. Its use is contraindicated in pregnancy because of the danger of producing an abortion or possibly a condition of intersexuality in the fetus.

Male sex hormones have been used in the treatment of prostatic hypertrophy with varying results. There has been noted general improvement and better micturition; this is ascribed to the stimulating effect on the bladder musculature. The size of the prostate has not been influenced. There have been a number of theories proposed as to the causation of prostatic hypertrophy in old men. Jongh and Laqueur have suggested that there is a diminution of the male sex hormone in old men as compared to the proportion of the estrogens. There have been contradictory findings and views on this aspect of the subject. Thus Kochakian reported a diminished excretion of androgens in the urine of old men. The treatment of prostatic hypertrophy is still based on surgical principles. JACOB E. KLEIN, M.D.

# SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS

## CONDITIONS OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

**Sciatic Pain in Low Back Derangements; Its Incidence, Significance, and Treatment. A Symposium.**
**Chandler, F. A.: Introduction.**
**Willis, T. A.: Anatomical Variations and Roentgenographic Appearance of the Low Back in Relation to Sciatic Pain.**
**Craig, W. McK., and Walsh, M. N.: Neuro-Anatomical and Physiological Aspects and Significance of Sciatica.**
**Kuhns, J. G.: Conservative Treatment of Sciatic Pain in Low Back Disability.**
**Barr, J. S., and Mixter, W. J.: Posterior Protrusion of the Lumbar Intervertebral Discs.**
**Farrell, B. P., and MacCracken, W. B.: Spine Fusion for Protruding Intervertebral Discs.**
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**Ober, F. R.: Fasciotomy for Sciatic Pain.**
**Heyman, C. H.: The Relief of Low Back Pain and Sciatica by Release of Fascia and Muscle.**
**Freiberg, A. H.: The Fascial Elements in Associated Low Back and Sciatic Pain.**
**Badgley, C. E.: The Articular Facets in Relation to Low Back Pain and Sciatic Radiation.**
*J. Bone & Joint Surg.*, 1941, 23: 407–481.

FREMONT A. CHANDLER. This subject of sciatic pain in low back derangements is slowly yielding to careful scientific study and analysis. There are many potential etiological features in this syndrome, and treatment is chosen from a variety of therapeutic measures. There is no panacea and the orthopedic surgeon follows the oscillations of the therapeutic pendulum, and with the accumulation of experience, charts his own course of procedure in each case.

THEODORE A. WILLIS. The acceptance of congenital anomalies low in the back as the cause for sciatic pain has been temporarily overemphasized.

Congenital anomalies of the lumbosacral and sacro-iliac areas of the skeleton are of interest in the syndrome of low back pain and sciatica either as predisposing or etiological agents, or as factors preventing recovery from these symptoms following injury. Certain anomalies weaken the anchorage of the spinal column to the pelvis; others expose the contents of the neural foramina, particularly the last presacral nerve roots, to impingement, stress, or irritation from postural faults or disease.

The lumbosacral junction is the particular part of the human spinal column most subject to mechanical strain, and most often involved in anomalies and defects of development.

It is doubtful whether bilateral, symmetrically enlarged transverse processes which do not impinge upon, or articulate with the sacrum or ilia, weaken the sacro-iliac juncture. Since processes and nerves develop simultaneously, it is improbable that they are maladjusted; but with the development of lordosis or muscle spastic ty the tension on the nerve or blood vessels might be increased, as in cervical-rib syndrome.

Asymmetrical anchorage of the lumbar column to the pelvis predisposes the part of the back involved to strains and sprains. The asymmetry may be in the size and attachment of the transverse processes or in the planes and inclinations of the articular facets.

A congenitally narrow lumbosacral interspace, approaching the first sacral interspace in depth, diminishes the size of the foramina through which the last lumbar nerve roots emerge and thus increases liability of the transmitted nerves to pressure from accident, disease, or lordosis.

The lumbar spinous processes provide large surfaces for the attachments of the powerful ligaments and muscles that stabilize the lower back.

Skeletal anomalies are often associated with defects of the soft tissues, particularly of nerve tissue. A cleft of the neural arch may be associated with defective development of the spinal cord and its nerve roots in minor as well as major spina bifida.

A lesion more definitely affecting stability of the lower back is the lateral defect of the neural arch. Hitchcock attributes this to a fracture of one or both laminæ incurred in early infancy before they are well ossified or fused. The injured cartilaginous tissue fails to ossify and the anchorage of the spinal column to the sacrum depends upon fibrous union only. The incidence of laminar defects is about 5 per cent.

Muscle fatigue in the lower back gives rise to discomfort which increases as the cause of fatigue continues. As the musculature fails, more and more strain falls upon the ligaments and joint structures. These inelastic tissues gradually give way and inflammatory changes occur, together with soreness, restricted mobility, and pain both locally and along the distribution of the nerves that supply the affected parts.

Possible mechanisms of low back and sciatic pain resulting from congenital skeletal anomalies are chronic muscle strain and ligament sprain; tension on, or compression of, nerve roots; and associated anomalies of nerve tissue.

There is still a greater incidence of anomalies in painful backs than in those free from symptoms or in the usual run of dissecting-room cadavers.

WINCHELL MCK. CRAIG and MAURICE N. WALSH. No type of pain is absolutely pathognomonic. Pain occurring in the distribution of the sciatic nerve may be caused by a lesion of the spinal cord or nerve roots (especially from the fourth lumbar to the third sacral segments from which the sciatic nerve and its components are derived), by affections of the lumbo-

sacral plexus, or by lesions of the sciatic nerve itself.

Pain which is more or less limited to the sciatic distribution has been observed to accompany lesions of the lumbar, thoracic, or even cervical portions of the spinal cord.

Pain caused by intramedullary lesions of the spinal cord usually can be distinguished from that caused by irritation of the posterior nerve roots and ganglia.

Pain of central origin referable to lesions of the spinal cord is uncommon. When it occurs, however, it may be of a peculiar, agonizing type which is sometimes described as "aching, breaking, or piercing," and which is accompanied by dysesthesia and various disagreeable sensations such as the sense of "burning" elicited by pinpricking, and "vibratory electric-light sensation" produced by thermal or tactile stimuli. There is usually marked loss in the various forms of sensation below the level of the lesion, together with hyperactivity of the tendon reflexes and the occurrence of pyramidal-tract signs below the level of the lesion. In the cervical or lumbar region there is a loss of tendon reflexes if the lesion occurs in the segments which mediate tendon reflexes from the extremities, such as the cervical or lumbar enlargements of the spinal cord. The pain of central lesions usually is not affected by coughing and sneezing and is rarely worse at night. There may be local tenderness to percussion at the site of the lesion.

The nerve roots forming the cauda equina arise from the lumbar and sacral regions of the spinal cord, descend in the subarachnoid space intradurally, and are freely movable except as they approach their exits, where they are fixed. Thus it is that intraspinal lesions can displace and impinge on nerve roots without causing any motor, sensory, or reflex changes, and can produce the objective symptom of pain. It is a well-known fact that the pain of caudal tumors masquerades as low-back and sciatic pain for months and years before the tumor produces any objective neurological signs, and for the same reason protruded intervertebral discs and hypertrophied ligaments can produce pressure on nerve roots without producing any symptom except pain.

Intraspinal lesions of the fourth and fifth lumbar or the first and second sacral nerve roots immediately after their emergence from the cord, during their course as part of the cauda equina, or in the neighborhood of the intervertebral foramina, commonly produce sciatic pain. Lesions involving or compressing these nerve roots give rise to the type of pain known as "radicular pain." This type of pain usually is sharp, rarely aching or burning, and is often exaggerated by coughing, sneezing, or sharp flexion of the head on the chest. It tends to be worse at night, a fact which is presumably due to elongation of the spinal column while the patient is in the supine position with resulting traction on the nerve roots. It is commonly accompanied by local tenderness to percussion over the region of the spinal column at the level of the lesion, muscular weakness, reflex changes, or paresthesia. Sensory changes, should more than one nerve root be involved, may be found, the dermatome or dermatomes affected depending on the nerve roots which are compressed. It should be emphasized, however, that all these features need not be present to permit the diagnosis of radicular pain. In fact, it is rather rare for one patient suffering from radicular pain to demonstrate all of these characteristics.

Since the spinal cord comes to an end opposite the intervertebral disc of the first lumbar vertebra, the lumbar and sacral nerve roots which compose the sciatic nerve arise opposite the twelfth thoracic and first lumbar vertebræ. Thus, extramedullary lesions at this level may produce sciatic pain of radicular type, and this is probably the highest level at which it can be obtained. Lesions at this level, however, are very likely early to involve the centers for control of the sphincter muscles, since the parasympathetic nerve supply for the urinary bladder and sphincters arises from the second and third sacral segments of the cord, and the sympathetic nerve supply arises from the second to the fifth lumbar segments, whereas the first to the third sacral segments mediate the control of the rectal sphincters, as well as of the genital muscular system.

Lesions of the spinal cord itself tend to produce sharply localized segmental sensory, motor, and reflex changes. This is frequently not the case when lesions involving the nerve roots in the cauda equina are present. The roots are freely movable and small lesions in the spinal canal may cause no symptoms. The lesion may involve several nerve roots, a circumstance which confuses accurate localization. The pleurisegmental nerve supply to the muscles of the lower extremities and the tendon reflexes mediated by more than one segment of the spinal cord increase the difficulty.

The patellar reflex involves the second, third, and fourth lumbar nerves and the corresponding segments in the spinal cord; the Achilles and internal hamstring reflexes, the fourth and fifth lumbar, and the first and second sacral nerves and segments; whereas the external hamstring reflex is mediated by the first, second, and third sacral nerves and segments.

The distribution in the skin of the spinal nerves forms well defined, although overlapping areas known as "dermatomes," and it is important to remember that involvement of one nerve root alone cannot be expected to produce sensory changes, and that, consequently, only those lesions which involve two or more nerve roots will produce a loss of sensation.

At present, contrast media are usually employed to localize the lesion accurately. As knowledge of the syndrome has increased, however, it has been possible to diagnose and localize more or less accurately certain instances of protrusion of the intervertebral discs, so that direct exploration was pos-

sible. Because more than 90 per cent of instances of protruded discs occur at the fourth and fifth lumbar interspaces, it should be possible to predict the situation of the lesion among patients who have the typical syndrome of the protruded intervertebral disc.

In view of the present increased knowledge of the syndrome of protruded disc, however, it would be possible to explore the fourth and fifth lumbar interspaces directly, and avoid the use of a contrast medium, but the investigator should always keep in mind the fact that posterior protrusions of discs may occur rarely in the third, second, or first interspace, that multiple protrusions of discs may occur, and that removal of only part of the cause for the patient's symptoms cannot be expected to give symptomatic relief.

The profuse supply of sensory nerve endings in the annulus fibrosus and the posterior longitudinal ligament may account for some of the heretofore unexplained painful symptoms in cases in which the compression is limited to the lower lumbar and lumbosacral regions, and in which a tear of the annulus fibrosus has led to herniation of the intervertebral disc. It is possible that this observation may also explain the occasional puzzling observation of sensory changes in a dermatome higher than the level at which protrusion of the disc or the tumor found at operation occurred.

That all of the nerve reactions involved in the referred somatic manifestations of visceral disease are facilitated by the hyperirritability of the centers in the spinal cord produced by the exaggerated visceral stimulation seems probable. The degree of hyperirritability produced in the spinal cord, furthermore, may be a determining factor in the intensity of both the direct pain occurring in the viscera and the referred pain.

Since the joints, ligaments, muscles, and tendons of the lower part of the back are subjected to unusual strain, a study of their innervation has been made with the idea of attempting to learn in which region pain referred from lesions of these structures might be expected to occur.

Various theories from the literature are presented. With few exceptions, pathological proof of lesions situated in the fasciæ, muscles, and joints usually is lacking. It is extremely probable that referred pains from these sources do occur in the lower extremity, but it is difficult to estimate their frequency. An intraspinal lesion should be eliminated before the physician concludes that the patient's pain is referred from some distant focus. Lesions of the nerve roots in the intervertebral foramina are relatively uncommon. Sciatic pain is rarely produced by lesions of the lumbar plexus. It is, however, not infrequently produced by lesions of the sacral plexus. Lesions of the peripheral nerves may be caused by inflammatory affections of the nerves, trauma, pressure, or degenerative changes, and they may produce lesions which produce conditions commonly spoken of under the heading of "neuritis."

Symptoms of neuritis vary, of course, with the severity of the affection. In perineuritis there is an extreme amount of sharp, lancinating, boring pain down the course of the nerve. Chills and fever with leucocytosis and general malaise may accompany the process. The pain is severely increased by movement of the part. The nerve trunk is swollen, frequently tender, and palpable. The skin of the region supplied by the cutaneous nerve may be tender to pressure and show vasomotor changes. Sensory loss, motor weakness and paralysis, and areflexia occur.

A study of a group of patients suffering from true sciatic pain gives the impression that the term "neuralgia" should no longer be used to describe this type of pain, because most of such instances of pain probably are the result of neuritis of the sciatic nerve or its branches. Injuries to the peripheral nerves may produce the well known phenomenon described as "causalgia." It has been suggested that causalgia might be sympathetic in origin because of the associated vasomotor disturbances, and the emotional response of the individual to stimulation.

The affections of 576 of the 1,000 patients used as the basis of this report were diagnosed primarily as muscular or ligamentous strains in the region of the low lumbar spine and sacrum. In 325 others a ligamentous strain was diagnosed in conjunction with disease or deformity of the vertebræ.

J. G. Kuhns. The lumbosacral region of the spine is the weakest portion of the vertebral column. Contributing factors to sprains at this area are anomalies and diseases of the vertebræ and faulty habits of use of the body. Faulty body mechanics leads to impaired functioning of the muscle supports, defects in balance against gravity, and the tendency of the low spinal joints to be used at the limit of their extension.

In most instances of low back pain, the lesion causing the pain is presumed to be a ligamentous tear or a separation of fibers at the musculotendinous junction. Evidence for this assumption is found in local tenderness over the ligamentous structures. In a few instances there are superficial ecchymoses. Novocaine injections into the most tender areas often produce temporary relief. Disappearance of the pain and disability is frequent after immobilization and support with relaxation of the injured part.

In the presence of congenital anomalies and faulty body mechanics which hasten the occurrence of symptoms by causing malalignment of the spine and inefficient functioning of the supporting structures, a slight trauma, such as a sudden unguarded movement, may produce a severe sprain of the low back. The instability induced in the low back by the faulty body mechanics is shown in roentgenograms by the tendency of the sacrum to assume a more nearly horizontal position, by the thrust of weight coming upon the articular facets at the limit of extension, by the increase in the lordosis with overriding spinous processes, and by the rotation and marked downward displacement of the lower ribs.

Treatment should attempt to relieve immediate disability and also do whatever is possible to avoid a

recurrence. Rest with the injured structures in a position of relaxation until healing is at least partially completed is regarded as adequate treatment for the usual cause of low back disability, and this is similar to the treatment used for muscular and ligamentous tears elsewhere in the body.

It is possible to secure relaxation of most of the posterior ligamentous structures about the sacrum and lumbar spine by supine recumbency with the lumbar spine flat, and with slight flexion of the hips. The author can find no mechanical basis for traction upon the legs in extension for relief of the usual types of low-back pain.

The best method of securing immobilization and ligamentous relaxation for the low back is to keep the patient constantly on a firm bed with the entire body horizontal except for slight flexion at the hip joint. This can be secured in the supine position by placing a pillow under the knees, or in the prone position, under the abdomen. With very severe ligamentous injury it may be necessary to apply a plaster back shell or a plaster spica to hold the patient more continuously in this position temporarily.

Adequate conservative treatment should include heat applied to the injured portion of the spine, and, when movements can be performed with relative comfort, exercises to teach the patient how to use the body habitually in good body mechanics. Later, when the patient is first ambulatory, a support should be fitted with the patient's body in the best corrected posture possible, so that strain will not come upon the healing structures. The spinal support should be discarded gradually as the patient loses his pain and limitation of motion, and learns how to use the body habitually in a position which is not at the extreme of extension, but midway between full extension and flexion.

Pain referred along the sciatic nerve is relieved by such treatment in approximately 79 per cent of all patients who present this symptom.

Low back disabilities caused by ligamentous and muscular strains, acute or chronic, with or without an associated bony change, respond most frequently to conservative treatment. Manipulation may be required in a few instances to restore normal mobility. When structural restoration cannot be expected, as in metastatic malignancies, conservative therapy may prolong function and is of great help in palliative treatment. Conservative treatment is of little aid in the treatment of low back and sciatic pains caused from pressure or irritation within or about the spinal cord.

JOSEPH S. BARR and WILLIAM JASON MIXTER. Posterior protrusion of one of the lumbar intervertebral discs into the spinal canal is one of the most common mechanical derangements of the low back in patients suffering from intractable sciatic pain. The leg pain is due to direct pressure of the displaced intervertebral-disc tissue on one or more roots of the cauda equina. In addition to this lesion, there may be found associated thickening of the ligamentum flavum, chronic adhesive arachnoiditis, hypermobility of the involved vertebræ, and edema of the involved nerve roots. Although the etiology of posterior disc protrusions is not perfectly clear, trauma to and degenerative changes in, the intervertebral discs alone or in combination seem to be the usual causes of posterior protrusion.

Among the most common and characteristic symptoms and signs, are intractable sciatic pain following a lifting injury, accompanied by limitation of back motion and of straight-leg raising, sciatic scoliosis, and lumbar kyphosis, tenderness over the lower lumbar spinous processes, and absence of the ankle jerk. The total protein of the spinal fluid is usually elevated. There are no changes on the routine roentgenograms characteristic of ruptured intervertebral discs, but narrowing of the fourth lumbar disc is of some importance if the clinical picture is characteristic. Lipiodol examination is highly accurate in making the correct diagnosis and in localization of the lesion, but because of the potential danger, the use of lipiodol should be reserved for cases in which surgery is necessary. In a series of 155 cases of proved intervertebral-disc protrusion into the spinal canal, verified by operation at the Massachusetts General Hospital, 139 (90 per cent) occurred in the lumbar region, the fourth and fifth lumbar discs being the ones involved. The lesion is laterally placed, usually directly beneath the articular facet, and, when of sufficient size, the nerve root between the ruptured disc and the facet just before its exit through the intervertebral foramen are compressed. A lesion at the fourth lumbar disc invariably compresses the first sacral root, provided the protrusions are of sufficient size to cause nerve-root pressure. This is due to the fixation of the root in its dural sheath at its point of exit through the intervertebral foramen. A satisfactory method for removal of lipiodol is now available (A. O. Hampton and C. S. Kubik). This makes it unnecessary to operate on those cases that have had negative lipiodol examinations and obviates the danger of late arachnoiditis due to irritation from the retained lipiodol. Pneumomyelography and clinical localization of the lesion may make the use of lipiodol necessary in not more than one-half the cases. Conservative treatment should be tried in every case of suspected protrusion of the intervertebral disc unless there is obvious serious nerve-root pressure, as shown by objective sensory or motor disturbance. Bed rest and immobilization of the lumbar spine in a plaster jacket seem to be the most effective means of conservative treatment.

Surgical treatment consists in the removal of the ruptured disc fragment through as small a laminectomy incision as possible. Spine fusion at the time of the laminectomy seems to give definitely better results than laminectomy alone. A modified Hibbs method which reinforces the fusion with an osteoperiosteal graft and additional bone chips from the tibia is used. No attempt is made to bridge the laminectomy defect. There is a definite place for fusion in selected cases, and about one-third of this series of cases were fused. Whether fusion is performed or

not, strenuous activity and heavy work are not permitted for six months after operation. It is unnecessary to emphasize that muscular rehabilitation by means of carefully graded exercises should be an integral part of the postoperative care of every patient. Details of the after-care vary with the physician in charge. Manipulation of the spine in cases in which disc involvement is suspected is strongly condemned. It may result in paraplegia.

Of 94 patients with proved ruptured intervertebral disc followed up for at least one year after operation, 77 per cent had complete relief from sciatic pain, and an additional 18 per cent had only minor leg pain. There were 2 proved cases of recurrent ruptures in this series.

The relief of back symptoms was not as satisfactory as the relief of the radiating leg pain. Seventy-three per cent of the patients in whom the spine was fused and 52 per cent of the patients without fusion had no back symptoms. The rest had complaints of backache or weakness of varying severity. In a small series in which insurance compensation was involved, 45 per cent of the patients were returned to their original occupation.

BENJAMIN P. FARRELL and WILLIAM B. MACCRACKEN. The diagnosis of protruding intervertebral disc is not one easily made. Clinical examination, spinal puncture, roentgenograms, and air myelograms have, in the authors' hands, been ineffectual in establishing an accurate diagnosis. Furthermore, spine fusion alone has accomplished in many cases, which were clinically indistinguishable from cases of protruding disc, as good results as laminectomy, and as spine fusion with the removal of the disc protrusion. Theoretically, the majority, if not all, of the cases of protruding intervertebral disc can be relieved by fusion alone.

Of 33 laminectomies, 3 showed no pathology. The other 30 cases included 10 of protrusion of the intervertebral disc, 5 of hypertrophy of the ligamentum flavum, 1 case of extradural scarring, 1 of varicosity along a nerve root, 2 cases of neurinoma, and 11 of adhesive arachnoiditis. Four cases of protruding disc and 2 of hypertrophy of the ligamentum flavum had arachnoid adhesions as well.

This variety of conditions not specifically diagnosed before operation is evidence of the difficulty of accurate clinical diagnosis of intraspinal lesions. In most of these conditions, spinal puncture with manometric and total-protein determinations is of very doubtful differential value.

There may very well be cases of true compression of the nerve roots by protruding intervertebral discs, and certainly sciatic pain is occasionally associated with new growths within the spinal canal, but the greatest number of the authors' laminectomies revealed arachnoid adhesions between the nerve roots, or a disc protrusion small enough to allow adequate passage of the nerve roots. They found only one large herniation, 1 by 1.5 by 2 cm., which was apparently causing considerable compression of the nerve root.

It has not been proved that a disc protrusion which merely angulates one or more nerve roots can cause symptoms in the absence of motion. Certainly the nerve roots are normally angulated about many structures in their normal course, and the spinal cord itself is often severely angulated at a tuberculous kyphos without producing any nerve symptoms.

Radicular pain resulting from a fractured vertebra or arthritic lipping with pressure on the nerve roots has long been known to be amenable to immobilization by bed-rest, or spontaneous or surgical fusion.

If the small disc protrusions cause nerve-root symptoms, it is much more reasonable to believe they do so by repeated sliding of the nerve over this protrusion with spine motions, than that they actually compress a nerve which is free to move away from the protrusion.

It is even more reasonable to believe that the small disc protrusion may often be an inconsequential element of a grossly unstable mechanical system. The stability of the lumbosacral joint depends not entirely on any one feature of its structure, but upon the composite of several elements and their relationship. The nature of the arch articulations, the angle of the superior surface of the sacrum, the presence or absence of impinging spinous processes and of anomalies such as partial sacralization of the fifth lumbar vertebra, as well as degenerative changes, must all be considered. A small disc protrusion, occurring in 15 per cent of Beadle's series of spines, would seem to be merely another factor to be considered in relation to the others.

In a study of 175 cases treated by lumbosacral fusion for typical sciatic pain, 46 patients had some or all of the abnormal neurological signs now commonly attributed to protrusion of an intervertebral disc. It has been possible to see 27 of these patients for this study and they have been compared with 21 of those who had had laminectomy fusions.

The results in the group with spine fusions were almost the same as the results in the group with laminectomy fusions.

TABLE I. RESULTS OF OPERATIVE TREATMENT FOR SCIATIC PAIN

| Treatment | Cases | Average Relief of Pain (Per Cent) | 75 to 100 Per Cent Relief of Pain (Per Cent) |
|---|---|---|---|
| Fusion..... | 27 | 85 | 83 |
| Laminectomy..... | 21 | 84 | 87 |

Five patients have had laminectomy following fusion. Of these, 1 had a protrusion of the intervertebral disc above the fusion, 2 had arachnoid adhesions, and 1 had extradural scarring. The fifth had a laminectomy in spite of a pseudarthrosis of the original spine fusion because the neurological signs were not thought to be attributable to the pseudarthrosis alone. No intraspinal pathology was found in this case. In these 5 cases there was none with any appreciable improvement following laminectomy.

The authors submit that the need for laminectomy in treating protruding intervertebral disc has never

been established. They present presumptive evidence that spine fusion alone is as effective as laminectomy and fusion, and suggest that fusion alone, a theoretically sound procedure, may be the treatment of choice.

HENRY W. MEYERDING. In the past two years the author has been impressed by the number of cases in which the patient had spondylolisthesis associated with sciatic pain and protrusion of an intervertebral disc. Protrusion of an intervertebral disc was diagnosed in 15 of the 25 cases in which spondylolisthesis was associated with sciatica, and the diagnosis was confirmed in 6 cases in which operation was performed.

The author believes that patients afflicted with spondylolisthesis are more likely to have protrusion of an intervertebral disc than are those who have a more stable spinal column. Trauma is a definite factor in this condition.

Marked displacements in spondylolisthesis are accompanied by fewer complaints, than are the lesser grades, which indicates that there may be some factor other than spondylolisthesis involved in the production of the sciatic pain.

A thorough neurological investigation, including spinograms, is now a routine procedure for those patients with sciatic pain for whom the diagnosis of spondylolisthesis has been made. This is especially emphasized for those who have diminution or loss of the Achilles reflex, with pain, numbness, or paresthesia.

The neural arch remains behind and, although the cauda equina and roots may be slightly stretched, there is enough roŏm, in the large spinal canal, to prevent direct pressure on the cauda equina. In patients with the congenital types of spondylolisthesis, and in those in whom development was slow, there is rarely any paralysis, because nature compensates for stretch and pull. In the cases in which the injury is acute and severe, with fracture or rotation of a vertebra or vertebræ, it is obvious that evulsion of nerve roots, pressure of bone fragments, hematomas, and paralysis of the caudal segments may occur. Thus, it would seem that the common symptoms of spondylolisthesis, such as backache, pain, and paresthesia referred to the buttocks and legs, are the results of instability of the lower portion of the spinal column with subsequent irritation and strain, rather than the results of direct pressure. The protruded disc, on the other hand, may cause direct pressure on the nerve roots. When the protrusion occurs in the center, bilateral distribution of pain may result, but when the protrusion is to the side, pain arises from the corresponding nerve-root distribution and sciatica results.

It is Meyerding's opinion that fusion of the lumbosacral region is desirable in those cases of spondylolisthesis with symptoms of protruded disc in which the surgeon is unable to demonstrate the disc at the time of the operation. This fixation of the spinal column will prevent movement and slipping, and is the most certain method of preventing additional symptoms of backache and sciatic pain. The treatment which offers the greatest benefit, the shortest period of disability, and the longest period of relief is surgical removal of the protruded disc and fusion of the last three lumbar vertebræ with the sacrum.

Patients have been seen for whom all means of combating the backache and sciatic pain have failed and for whom conservative measures have been initiated without relief, and the author is, therefore, firmly convinced that such measures are of little permanent value. In spite of accurate diagnosis and explanation as to the cause of a patient's disability, there will always be those who refuse surgical treatment and who will have to be treated conservatively. The persistent wearing of the lumbosacral corset with reinforced steel stays, and local applications of heat are, when combined with medication, perhaps the most efficient non-surgical measures. In the present series of 80 patients who had spondylolisthesis associated with sciatic pain, conservative measures were carried out for 49, or 61.3 per cent; surgical fusion was performed for 25, or 31.3 per cent; and surgical fusion with removal of a protruded intervertebral disc was performed for 6, or 7.5 per cent.

To insure relief of the sciatic pain and backache associated with spondylolisthesis, treatment must consist of immobilization of the lumbosacral region and relief of the intraspinal pressure. Insertion of bone grafts alone in an attempt to relieve sciatic pain in such cases is not considered sufficient. Removal of the protruded disc combined with the added safeguard of lumbosacral fusion is the method of choice. There is no doubt that some of the patients may obtain a measure of relief from surgical fusion alone.

Should there be considerable defect in the lamina, following the removal of the disc, the surgeon may use a graft of periosteum, sutured so that it covers the defect. To insure a strong bony support, two grafts are usually inserted, together with numerous fragments and cancellous bone that have been removed with a curette from the upper end of the tibia. The sides of the spinous processes, lamina, and facets are further roughened with a chisel or curette to insure bony approximation and ultimate fusion. The region which is usually fused consists of the third, fourth, and fifth lumbar, and the first two sacral vertebræ. The resultant mass of bone is the most secure fixation of the lumbosacral region that the author has been able to devise, and results from an application, with modifications, of the principles of fusion brought out by Albee and Hibbs.

FRANK R. OBER. Fasciotomy for the relief of demonstrable fascial contracture of the thigh has its place in the treatment of chronic lame backs and sciatic pain. Fasciotomy is now being performed quite extensively, and many surgeons have a better record of results than the writer. It should not be done indiscriminately for all sciatic pain, because there are often lesions of the back, of the sciatic nerve, or within the spinal canal which cause pain in the sciatic nerve. The abduction test was positive in every one of these patients and almost always present on

both sides. In several instances, in which the test was positive on each side and a unilateral fasciotomy for sciatic pain had been performed without relief, a later fasciotomy on the opposite side gave complete relief. It is to be remembered that conservative measures will still relieve a large proportion of these patients and should be tried faithfully.

The operation will, if properly performed, relieve a large number of cases of sciatic pain. In some instances there is early relief of the lame back condition when associated with sciatic pain. It has been found that the relief of low back pain, stiffness, and the associated poor posture is often slow. This is probably due either to the fact that the inflammatory condition is slow in clearing up, or that the physiological curves, having been distorted for years by the bad mechanics of abnormal fascial pulls on the pelvis and low spine, do not return to a normal posture quickly. In addition, the spinal curves, in returning to a normal posture, must exert pressure and tension on muscles, fasciæ, and ligaments which have not been subjected to normal conditions for years.

The operation is now performed as follows:

An oblique incision, from 4 to 6 in. long, is made from the lower edge of the anterior superior spine downward and backward, to a point just above the level of the greater trochanter and just posterior to it. The skin and subcutaneous fascia are separated by clean dissection above, below, and posteriorly, until a strip about 2 in. in width has been dissected well back over the anterior surface of the gluteus maximus muscle. The fascia is now divided from the anterior superior spine well back over this muscle. The fascia gaps at the incision, and the flaps are dissected off the muscles for about 1 in. on each side. All intermuscular septa are divided. If there is a positive Ely's sign, the fascia surrounding the sartorius muscle is also divided. All loose tags of fascial tissue must be removed. The length of postoperative time in bed depends on the severity of the back symptoms and the rapidity with which the sciatic pain clears up.

There were a small number of patients who had sciatica later on in the opposite side and these insisted on having the operation on the second side. One of these patients had had recurrent sciatica for ten years and operation stopped his pain within a month. Four years later he had sciatica in the opposite leg for two or three weeks and insisted on the same procedure for that side. There was complete relief within three weeks.

There have been only a few cases with recurrence and these have usually been slight and of temporary duration, and responded to conservative treatment.

Of the 86 cases, 41 have shown excellent results, 33 improvement, 5 only slight improvement, and 5 no improvement. There is no record in 2 cases.

CLARENCE H. HEYMAN. One no longer need hesitate in accepting a lesion of musculo-aponeurotic and ligamentous origin as a primary source of irritation and the origin of low back pain. Slocumb tentatively classifies two types, a primary and a secondary. The primary type is unaccompanied by, and is independent of, any other definite disease, and presumably is attributable to unidentified infections or toxemia. The secondary type is secondary to arthritis, trauma, or influenza.

Symptoms of fibrositis are muscle tenderness, stiffness, tenderness over insertions, and pain, particularly when the part is put on a stretch. Pain may be accompanied or replaced by a referred pain felt in the area of the skin corresponding to the nerve root which conducts the afferent impulse, and tenderness to deep pressure in the muscles in the same segmental area.

Since posterior stripping has relieved carefully selected cases of low back pain or sciatica, one must conclude that the source of irritation lay in a superficial focus in ligaments, fasciæ, muscles, aponeuroses, or at their periosteal attachments. It is difficult to conceive that the operation corrects sacro-iliac or lumbosacral strain, or relieves a direct irritation upon the components of the sciatic nerve. It then becomes necessary to assume that there is a so-called fibrositis, which would appear to be the weak point of this argument, because there is no convincing proof that fibrositis is a pathological entity. Clinical evidence, however appears so convincing that it deserves a place as one of the three most common forms of rheumatic disease—atrophic arthritis, hypertrophic arthritis, and fibrositis. Fibrositis is a provisionally accepted entity causing low back and sciatic pain which may be relieved by posterior fasciotomy in selected cases not yielding to conservative treat ment.

There is no reliable single test or sign for this type of extra-articular origin of pain. The criteria for posterior fasciotomy depends upon the following factors:

Operation is reserved for the chronic case in which persistent symptoms or tension is not relieved by conservative treatment. Hence, only comparatively few of this large group of cases are suitable for operation. There must be localized tenderness at the musculo-aponeurotic or ligamentous insertions. However, there may be pain and tenderness along the segmental distribution, that is, sciatica. Generally there must be tension pain on stretching or active contraction against resistance. Passive relaxation is not painful, therefore passive extension of the lumbar spine must be free and without pain. A positive response of temporary relief following a local and not massive injection of procaine should be sought before proceeding with the operation. A coexisting and asymptomatic hypertrophic arthritis of moderate degree, revealed only by the roentgenogram, is not a contraindication to fasciotomy. Fibrositis may be secondary and only a part of the entire picture of arthritis, but still be the sole cause of symptoms.

The purpose of operation is to release tension of the ligaments, fascia, and muscles attached to the posterior superior spine and the posterior third of the crest of the ilium. This is done by subperiosteal

stripping laterally, medially, and inferiorly, together with division of the sacrospinalis fascia when tenderness or pain is present there.

The proposal to cut the piriformis muscle for the relief of sciatic pain was originally put forth with the idea that this might be welcome as a symptomatic release in certain cases which had failed to yield to non-operative methods. While the possibility of disease primarily situated in the muscle itself was granted, the operation was done in the absence of definite evidence of its existence. Muscle contracture of continuing character is most often secondary to a lesion situated elsewhere primarily. When the lesion is primary in the muscle or fascia, it is conceived to be the result of inflammatory disease—myofascitis or fibrositis. In no instance in which microscopic study of excised piriformis tissue was made was there a report of local disease. In the absence of this it is concluded that the role of the muscle in producing sciatic pain is secondary. The same thing will have to be said in the case of operation on other muscular or fascial tissue. Unless there is tangible evidence of disease in the tissue itself or in the dominant nerve control, a merely symptomatic release is unsatisfactory. The primary lesion will have to be recognized and subjected to suitable treatment. Such recognition often makes an operation of any kind unnecessary. Here, for the time being, at least, the case must rest.

ALBERT H. FREIBERG. Successful results have been observed by Freiberg in a limited number of cases treated by the methods of Heyman, Ober, or Steindler. These methods have been employed when it was thought that they were indicated, but in numbers too small to be worthy of statistical report. Like the explanation offered for the results of the piriformis operation, however, their explanation is one of rationalization rather than of proof. It would appear that the establishment of indications for the various procedures must rest largely upon such explanation, or upon a basis which is personal and empirical. Once surgical intervention seems called for, however, it will have to be acknowledged that in other operations an attack is being made upon structures much less directly connected with the sciatic trunk than is the piriformis muscle. Here we are at least concerned with a structure which is always in direct contact with the sciatic nerve, even though not always to the same extent or in precisely the same way.

CARL E. BADGLEY. The anatomical possibilities for the articular facets to play a more or less active part in the production of low back pain with or without sciatic radiation are obvious, but pathological evidence is not yet sufficient to make this conclusion a fact.

Sciatica is a condition in which the syndrome is the only constant factor; the causative factors are variable and may be single or multiple, but the role of the facets should be considered in every case.

It is important to recognize that the articulations formed by the vertebral articular processes are true joints provided with a complete capsule which is lined with a definite synovial tissue. Closely associated with the mesial aspect of the capsule are the ligamenta flava.

Brailsford, in a review of 3,000 roentgenographic studies of the lumbosacral spine, found that 57 per cent of the lumbosacral facets pointed backward, 12 per cent pointed inward, and 31 per cent were mixed or asymmetrical.

Goldthwait pointed out that if the facets were asymmetrical, the movements were irregular.

Von Lackum, in an anatomical study of 30 cadavera with 18 grossly asymmetrical lumbosacral facets, states that when the articulations are asymmetrical they result in unequal rotation, a factor that also contributes to the weakness of the part. When there is associated with this condition a poor muscular or ligamentous development, or when there is a settling down of the superior facets onto the inferior facets from any cause, a very potent reason for disability or abnormality is established. Rotation of the lumbar, and particularly of the lumbosacral articulation, occurs to a greater extent than anatomists have recognized. In this region it takes place chiefly in the facets, instead of in the intervertebral discs as it does in rotation in the thoracic region.

Willis has pointed out that developmental variations of the articular processes in size, shape, and angle of projection occur particularly in the lumbosacral region. He also states that poorly developed and asymmetrically formed articular processes strongly suggest mechanical instability and susceptibility to ligamentous injury.

Not infrequently there is an asymmetrical development of the articular portion of the facets on the corresponding sides, with a difference in size as great as 6 to 8 mm. in the transverse diameter. It is probable that the fissure formations, usually in the interior articular facet, are the result of anomalous development. Fracture may occur, but it is usually found only with evidence of fracture elsewhere in the spine. Putti also found evidence in the articulation of the facet of synovial villi which were extremely variable in shape, size, and appearance, frequently having two lobes, sometimes the size of the head of a large pin, sometimes leaf-shaped. They are rich in blood vessels.

Badgley has previously presented his theory of postaxial radiation as referred pain, not necessarily produced by direct nerve irritation. The excellent response to conservative treatment in the cases without neurological signs, verifies his contention that 80 per cent of the cases of low back pain with sciatic radiation are on the basis of referred pain, and not direct nerve irritation.

The sensory nerve supply of the capsule of the facets is sufficiently well determined to support the conception that irritation of the capsule of the lumbar articular facets could well produce pain stimuli which could return to the central nervous system through the primary posterior division and produce referred pain through the dermatomes of the in-

volved nerves. The last correspond exactly with the pathway of sciatic radiation, namely, the fourth and fifth nerves. Thus sciatic symptoms on a referred mechanism, but along the same pathway as direct nerve irritation, can conceivably be produced.

Putti for years maintained that sciatica is a neuralgia caused by a pathological condition of the intervertebral foramina and especially of the intervertebral articulations, the articular facets. He said idiopathic sciatica is essentially the result of vertebral arthritis involving chiefly the articular facets.

Arthritis of the facets is rare under thirty years of age, but is progressively more frequent and severe with age. Intervertebral arthritis is more common between the third and fourth, and fourth and fifth lumbar vertebræ, and a little less common, surprisingly enough, in the lumbosacral region itself. Arthritis of the facets is more commonly associated with the asymmetrical facets. Lesions of the articular capsules were found in 57 of the 75 cases, appearing usually in the upper and mesial part of the capsule with edema, granular ossification, calcification, and adhesions between the capsule and the meningeal covering of the nerve root adjacent to it.

A mechanically unsound joint in the hip or elsewhere shows reaction to irritation as the patient ages, and so must the asymmetrical and mechanically poor facets. From Putti's studies he concluded that arthritis of the articular facets is the rule in practically all patients over forty years of age. The frequency of arthritis in the facets as age progresses, and the frequency of low back disturbances in similar age periods are coincidental facts of very probable significance. ROBERT P. MONTGOMERY, M.D.

**Stauffer, H. M., Arbuckle, R. K., and Aegerter, E. E.: Polyostotic Fibrous Dysplasia with Cutaneous Pigmentation and Congenital Arteriovenous Aneurysms.** *J. Bone & Joint Surg.*, 1941, 23: 323.

Polyostotic fibrous dysplasia is a term proposed by Lichtenstein for a type of fibrous dystrophy involving multiple bones. It appears to be a clinical entity and is characterized by unilateral bone lesions with deformities, pain, and limping. Pathological fractures with malunion are common. The long bones of the leg and arm are usually involved by progressive lesions which eventually become static. Roentgenographically the shaft is expanded, with an irregular porosity and apparent trabeculation often resembling cysts. The cortex is markedly thinned. Chemical studies reveal normal values for serum calcium and phosphorus. Elevation of serum phosphatase is frequent. The pathology is a replacement of cancellous bone and marrow by avascular fibrous tissue without evidence of inflammatory or neoplastic changes, the microscopic picture being similar to that found in osteitis fibrosa cystica. The cause of the disease is probably a unilateral congenital disorder of the bone-forming mesenchyma. Its correct differential diagnosis from hyperparathyroidism may prevent an unnecessary operation on those glands.

The authors report a thoroughly studied case of this disease associated with cutaneous pigmentation and arteriovenous communications on the same side of the body. CHESTER C. GUY, M.D.

**Axelrad, L. D.: Changes in the Spine Following Tetanus.** *Nov. khir. arkh.*, 1941, 48: 183.

The author collected from the literature reports of 36 writers describing 100 cases with pathological changes of the spine following tetanus, and he adds a case of his own.

The gravity of changes in the vertebral column has no relation to the age of the patients. In all cases reported only the thoracic spine was involved; lesions of the fourth to seventh thoracic vertebræ dominated; those of the third, eighth, and ninth vertebræ were less frequent; while the tenth vertebra was affected only in exceptional cases. As a rule, a compression fracture with a wedge-shaped deformity was present. Arches and processes were not fractured. In a limited number of cases a compression of the intervertebral disks was discovered and in a few instances the nucleus pulposus was pushed deeply into the body of the vertebra.

Sometimes a deformity of the vertebral column may appear relatively late after tetanus and therefore repeated roentgenographic examinations of the entire spine in the course of one to two years are advisable. The character of the fractures is not specific for tetanus. Convulsions may be responsible for more or less pronounced fractures which later on may lead to wedge-shaped deformities under the influence of the body weight. Similar late changes in the vertebral column, following an acute trauma, have been described by Kuemmel. Traumatic deformities may affect either normal vertebræ or those with trophoneurotic or metabolic changes. Pathologico-anatomical studies on persons who died from tetanus disclose degenerative changes of internal organs. Therefore it can be assumed that identical changes take place also in the spinal column.

JOSEPH K. NARAT, M.D.

## SURGERY OF THE BONES, JOINTS, MUSCLES, TENDONS, ETC.

**Grasso, R.: Spontaneous Evolution of Acute Hematogenous Osteomyelitis and Its Expectant Treatment; Minimal and Delayed Intervention** (Evoluzione spontanea della osteomielite acuta ematogena e suo trattamento aspettante: intervento minimo e ritardato). *Policlin.*, Rome, 1941, 48: sez. prat. 601.

Until a few years ago, the diagnosis of acute hematogenous osteomyelitis was the signal for immediate intervention, and this aggressive, urgent treatment was lately perfected and completed by the use of vaselined drainage, postoperative immobilization, and rare medications. However, the results of early surgical treatment were unsatisfactory. The supporters of the expectant method claim that acute hematogenous osteomyelitis is only a complication

in the course of sepsis, and a complication that is not always injurious. In the first phase of the disease, there is no osteomyelitic but a septicemic or septicopyemic patient, there is no localized disease, and the patient is not a surgical case but a medical one. To prescribe a rational treatment it is necessary to know the spontaneous evolution of the morbid process. The abstentionists have observed two stages in the spontaneous course of the disease: (1) a general picture of sepsis with high fever and often positive blood culture, which lasts for about two weeks; and (2) improvement in the general condition, fall of the fever by lysis, negative blood culture, frequent formation of abscess and of fistula, and better remote results.

Grasso reviews the 8 cases admitted to the first pavilion of the policlinic of Rome in 1939: the age of the patients varied from eight to seventeen years and the treatment consisted of immobilization. The number of cases is too small to allow definite conclusions, but it permits offering the following considerations. The final result was good in all cases although the cases represented grave forms of the disease, the localization of which was in the distal metaphysis of the femur in 4, and in the proximal metaphysis of the femur, the tibia, and the humerus and in the entire tibia in 1 case each. There were no secondary septic metastases in the bones or organs in any of the cases, nor were there any local complications such as phlegmonous infiltration, arthritis, or spontaneous fracture; there was 1 epiphyseal detachment, but it was due to insufficient immobilization. The 3 gravest cases gave the impression that the immobilization and hydration had greatly helped to overcome the serious general infection: these patients could not have stood an operation, could not have had a favorable postoperative course, and could not have shown esthetic and functional results comparable to those obtained by the expectant method.

Healing occurred without the use of incisions in 2 cases in which the roentgenograms showed a picture of sequestrum; simple incision of the subcutaneous abscess was sufficient in 3 cases; and an easy, late sequestrotomy was required in the remaining 3. The spontaneous evolution of the cases revealed that immediate intervention, besides being superfluous and possibly dangerous, would have missed the exact site of the osteomyelitic focus and would not have avoided the formation of sequestrum. Roentgen study has confirmed the observation of Loehr that after two or three weeks there may be an image of large total sequestrum which later loses its characteristics and shows itself as compact bone; consequently, the roentgen data on sequestrum will probably have to be revised. Early expectant treatment shortens the hospitalization of the patients, who can be discharged in about thirty days and later readmitted for a few days if sequestrotomy is found necessary.

In all cases, abstention has favored the spontaneous morphologic and structural reconstruction of the bone and has left no deformity, ankylosis, extensive or adherent scars, or neuralgias. Immobilization must be early and absolute in a plaster cast with little cotton wool, and must include the proximal and distal neighboring joints. If an abscess forms after immobilization during the first septicemic period, it is advisable to open it at its most dependent part; if a sequestrum forms, it should be removed if it is of average size, but not before three months have elapsed. Time only will tell whether these nonoperated cases will later give rise to the forms of chronic or recurring osteomyelitis which are so frequently observed in cases which have been treated surgically. RICHARD KEMEL, M.D.

**Wassersug, J. D.: Treatment of Tuberculosis of the Shoulder; A Study of End-Results.** *Arch. Surg.*, 1941, 42: 730.

The author reviews the cases of 24 patients with tuberculosis of the shoulder, 6 females and 18 males. The age of these patients on admission varied from fourteen months to fifty-seven years; the right shoulder was affected in 19 cases and the left in 5. Each of 12 of the patients had an arthrodesis, 11 were treated conservatively, and 1 underwent excision of the shoulder joint.

The author concludes that treatment of tuberculosis of the shoulder should always consist of sanitorium care followed by operation, but whether arthrodesis or excision should be performed is still an unsettled question in his mind. He stresses the fact that it is futile to operate in the presence of a rapidly fulminating disease or marked toxicity from multiple tuberculous foci. He believes that in children conservative treatment yields good results, but he does not give a detailed discussion of the operative technique or the postoperative period of fixation.
PAUL C. COLONNA, M.D.

**Van Nes, C. P.: The Treatment of Noticeable Shortening of One of the Lower Limbs** (Ueber die Behandlung erheblicher Verkuerzung eines der unteren Gliedmassen). *Nederl. Tijdschr v. Geneesk.*, 1940, p. 3854.

By noticeable shortening of the leg, the author means a shortening of at least 4 cm. The disadvantages of the use of shoes with built-up soles and other orthopedic apparatus are apparent in functional, cosmetic, and social respects, especially in women. These disadvantages have led to other means of treatment, such as attempting to increase the growth of bone on the shortened side, or stopping the growth on the sound side, by irritation or destruction of the epiphyses.

On account of the uncertainty of both, and the natural disinclination toward destructive action, these means have found little favor. The author states that there is great difficulty in lengthening the affected limb by chiseling through the bone. In infantile paralysis, tuberculosis, hip disease, and congenital dislocation of the hip, the maximum length obtainable is one-tenth of the length of the

affected bone. For instance, with a thigh of 47½ cm. this means 4¾ cm. If the shortening exceeds 5 cm. this procedure cannot be used. In addition, the treatment is of long duration, requiring at least nine months and sometimes as much as two years. Also, it is difficult to predict the exact length obtainable and, finally, the operation itself is difficult.

The author therefore believes that the best method of treatment is operative shortening of the sound leg. The femur can be shortened to one-fourth of its original length (12 cm. if it is 47½ cm. long), if necessary. Operation on the sound leg is simple and healing takes place in about three months. Furthermore the author believes that a better functional condition will result in the diseased limb, because atrophied muscles and joints are brought into play more physiologically after the sound limb is shortened. He recommends a medullary graft to secure union after shortening.

The best age for the operation is between fourteen and eighteen years. If one operates before fourteen years the affected limb might grow again, and if after eighteen years healing requires a longer time. However, the author operated upon a woman of twenty-one and one of twenty-three years of age, the former with a shortening of 10 cm. from infantile paralysis and the latter with a congenital shortening of 5 cm. Good results were obtained in both, but they were especially striking in the case with the shortening of 10 cm. since the patient was relieved of heavy orthopedic apparatus.

The author has used this procedure in more than 82 cases and recommends it highly.

(Richter). Hawthorne C. Wallace, M.D.

**Koontz, A. R., and Shackelford, R. T.: Comparative Results in the Use of Living and Preserved Fascia as Suture Material in Bone.** *Surgery*, 1941, 9: 493.

The authors performed 28 experiments on dogs, in which both living and preserved fascia was transplanted into bone in different ways, in order to show the fate of both types of fascia and to note any differences that might occur in the fate of the two types. In a few instances the fascia strips (both types) were transplanted in such a manner that they had no function to perform, but in most instances they were given the function of holding separated bone fragments together.

From this work, the authors have drawn the following conclusions:

Good results were obtained in suturing fractures of the olecranon in dogs, with both living and alcohol-preserved fascia strips, provided the parts were properly immobilized. No distinction could be made between the results obtained from the two types of fascia used, either functionally, or in so far as shown by gross, microscopic, and x-ray examinations.

Ossification of both types of fascia by replacement of fascia by ingrowing bone occurred as union of the fragments was accomplished. In cases in which immobilization was incomplete, but fibrous union occurred, both types of fascia were found intact months after implantation. When fascia (both living and preserved) was implanted in bone with no function to perform, rapid absorption took place.

Samuel H. Klein, M.D.

## FRACTURES AND DISLOCATIONS

**Grevillius, Å.: So-Called "Insufficiency Fractures"** (Ueber sogenannte Insuffizienzfrakturen). *Nord. Med.*, 1940, p. 2465.

A fracture due to insufficiency of the bone structure (Aleman), that is, failure of the otherwise apparently normal bony structure to bear weight, also called exhaustion fracture, chronic fracture, or pseudofracture, is a type explained on the basis of a gradual breaking of the bone resulting from exhaustion of the bony structure following repeated strains of a certain typical mechanism. This type of fracture appears most commonly as the so-called marching tumor (March fracture or Marschgeschwulst) of the metatarsal bones. Periostitis of the upper part of the tibia occurring in young soldiers, according to Aleman, is related to this type of fracture. Aleman regards the periostitis as the first stage of a fracture, although he never saw a fracture line in these cases. The spontaneous fractures caused by severe destruction of the bone or degeneration and the so-called avulsion fractures caused by a sudden, unusually strong contracture of the muscle do not belong to this group.

In the case of an "insufficiency fracture" the patient is not able to associate a definite accident which would be responsible for the fracture, nor can he determine the exact moment of the occurrence of the fracture because the pathological condition in question develops gradually on the basis of a bone transformation. Lacunar resorption and necrosis destroy the regular structure of the bone, which is subsequently substituted for by a tissue resembling poorly calcified callous tissue. In most cases no interruption of the continuity of the bone occurs. Healing takes place by gradually increasing calcification. The final causes of the "insufficiency fracture" are said to be endogenous (undernourishment and diseases of the skeleton), or mechanical (Henochen). The endogenous factor may affect the mineral constituents of the bone, while the latter or mechanical is understood to involve and destroy the microcrystals of the bony tissue. The fracture takes place especially in those spots which are more or less anatomically weak: for example, the upper part of the tibia where the resistance of the bone is insufficient to withstand particularly hard strain such as continuous goose stepping—especially in persons of poor condition and without training. The diagnosis is easy when the history discloses severe exertion followed by steadily increasing pain and swelling of the bone involved. However, when these symptoms are less pronounced the diagnosis may be quite difficult despite roentgen-ray examination, which by no means reveals a fracture line in every

case. The differential diagnosis from a malignant tumor is often impossible, as the history of a twelve-year-old boy proves. Within one and one-half months an enlargement with gradually increasing pain developed in the upper part of the right tibia. The skin covering the tumor was normal. Two roentgen-ray examinations taken at intervals revealed a spindle-shaped thickening of the periosteum 4 mm. wide, but did not permit a proper diagnosis. Ewing's sarcoma was suspected. Preliminary roentgentherapy with anticipation of a possible subsequent amputation of the leg was administered. Roentgenograms taken four weeks later proved the suspicion of a malignancy unfounded; the film demonstrated a complete fracture line. A cast was applied, and after three weeks the patient was discharged with the leg perfectly healed. Films taken a year later demonstrated no further pathology of the bone structure.

A boy four years old complained of pain in the upper part of the tibia with onset one week prior to the examination. The affected area was slightly thickened. The first roentgenogram made one suspicious of a fracture line; this became clearly demonstrated in the films taken two weeks later. Quick healing occurred.

The author described a third case. A soldier suffered from periostitis of a metatarsal bone due to military exercises (Marschgeschwulst). The clinical picture was outspoken; the periosteal thickening was very marked. Repeated roentgen examinations were made, all of which failed to demonstrate a clear fracture line.

As to the question of compensation, the author agrees with the viewpoint of Troell who considers cases of "insufficiency fracture" as compensable as any actual accident, provided they developed during work, even though specific signs of an accident might be absent. To be sure, the author makes the reservation that only a few days shall have elapsed before the noxious mechanism culminates in a fracture. (RICHTER). JEROME G. FINDER, M.D.

**Pollock, G. A., and Ghormley, R. K.: Early Repair of Bone; An Experimental Study of Certain Factors.** *J. Bone & Joint Surg.*, 1941, 23: 273.

Twenty-one mature female rats, each five months of age and weighing about 200 gm., were used. The right humerus of each rat was fractured, under anesthesia, at the junction of the middle and lower thirds. Group A consisted of 7 normal rats in which the humerus was fractured. Group B consisted of 7 rats which had been spayed two months previously. The rats of Group C corresponded in all details to those of Group B except that each rat received 2,000 international units of estrogenic substance on the second, fourth, and sixth days after the humerus was fractured.

Sealing of the medullary cavity appears to be one of the first steps in the healing of fracture. This may be produced by (1) a strand of periosteum, (2) a band of fibrin, or (3) a fibrinous-like plug produced by mass destruction of the red corpuscles. The seal is continuous across the cortex with the periosteum and later becomes infiltrated with fibrous-tissue cells from this membrane. In other cases, however, these cells may arise from the marrow or develop directly from the lymphocytes caught in meshes of this fibrinous medullary cap.

By the second day, the periosteum from the site of fracture to the neck of the humerus is thickened. This would appear to be the result of a general stimulation rather than that caused by local trauma. By the third day, osteoid tissue has developed subperiosteally in regions well removed from the fracture. At the same time, osteoid tissue has also made its appearance at the fractured ends of the bone where it has arisen from the endosteum and in conjunction with the original fibrinous plug formed a more efficient seal for the medullary cavity. The development of this subperiosteal bone along the entire shaft was considered one of the most interesting features of this study.

It was not possible to demonstrate any appreciable difference in the early stages of repair of bone in the three groups, but the impression was gained that injections of estrogenic substance stimulated the production of endosteal osteoid tissue. The insertion into the medullary cavity of a small plug of dense cortical bone as occurred in 1 of the cases could predispose to non-union.

**Urist, M. R., and McLean, F. C.: Calcification and Ossification. Control of Calcification in the Fracture Callus in Rachitic Rats.** *J. Bone & Joint Surg.*, 1941, 23: 283.

The primary object of the experiments reported in this article was to make the process of calcification and its relationship to the repair of bone accessible to analysis. The discussion is limited to these aspects of the subject; the other essential findings reported are included in the summary and conclusions. The author discusses healing of fractures in untreated florid rickets; the initiation of calcification in the callus by the administration of a single dose of phosphate; the control of calcification by the continuous administration of phosphate; calcification following the administration of Vitamin D; and the relationship between the state of the body mineral stores and the progress of calcification in the callus of healing fractures.

In the condition of florid rickets relatively free from phosphorus deficiencies, the fracture callus in rats remained completely devoid of bone salts for a period of from ten to fifteen days. During this period the influence of absence of calcification upon the healing of fractures and the effects of the initiation of calcification could be observed directly. At about the end of this period, calcification of the callus began spontaneously, without simultaneous calcification in the epiphyseal cartilage and the rachitic metaphysis. Given an adequate supply of bone minerals, calcification of the matrix of hypertrophic cartilage and of osseous tissue occurred promptly

and decisively. Osteogenesis and calcification could not be separated in the normal animal, so that it was impossible from the study of the normal animal alone, to determine how much the healing process itself was influenced by the deposition of bone salts in the matrix of cartilage and bone. These interrelationships have, however, been clearly demonstrated in the experiments and the observation reported.

The healing process in the fractures produced in rachitic rats began in the same way as in normal rats, and the formation of the fibrocartilaginous cartilage and the production of subperiosteal and subendosteal osseous tissue proceeded just as in the normal animal. However, in the absence of calcification after the fourth or fifth day following the injury a difference appeared which was clearly dependent upon the absence of calcification in the new tissues formed in the rachitic rat and those formed in the normal rat subjected to the same procedure. These differences are discussed, but it was difficult to determine to what extent they might be overcome in the complete absence of calcification, and just as there was a lag in the healing process in the absence of calcification, so was there a lag in response to calcification in the spontaneous or induced process. The authors believe that the initiation of the healing of fractures in the rat was not materially affected by dietary factors which prevent calcification, but that in the absence of calcification, the healing process was both retarded and transformed into a rachitic type of response. Moreover, when conditions for calcification were restored, there was a delay in restoration of the normal healing process because of encapsulation of the callus cartilage in a dense mass of connective tissue. Thus, even a temporary failure of calcification may materially retard the subsequent union of fractures.

Attention has been called to the rôle of the body mineral stores as a source of calcium salts which may be mobilized under the emergency of a healing fracture. This has been shown in adult animals, in which the growth is nearly static and the bone-mineral stores are nearly maximum, by the removal of phosphorus from the diet. After a period long enough to present a condition of phosphorus-deficiency without complete failure in the calcification mechanism, it was possible to show that the callus of a healing fracture received bone-mineral elements mobilized from the readily available body stores, and solid union could occur in the normal time with no other source of phosphorus. In an adult rat with a well developed skeleton, it should not be necessary to supplement the diet with mineral solely for the purpose of enforcing the structure of the uniting fracture, but in individuals with multiple fractures and in the very young, in whom the rapidly growing bone tissue everywhere in the body demands a continuous supply of minerals, measures which keep the mineral metabolism at its highest level are indicated from the earliest period after a fracture occurs. EMIL C. ROBITSHEK, M.D.

**Bogomoletz, O. A.: The Treatment of Fractures with Stimulating Doses of Anti-Reticular Cytotoxic Serum.** *Nov. khir. arkh.*, 1940, 48: 122.

All cellular formations taking an active part in bone formation belong to the physiological group of connective tissue. It follows that the course and character of repair of a fracture depends on the reactivity and regenerative properties of these structures. In the presence of identical mechanical conditions the rapidity of formation and functional quality of the callus are determined by a biological factor, namely, the reactivity of osteogenic cells of the connective tissue.

A. A. Bogomoletz found that small doses of anti-reticular cytotoxic serum have a stimulating effect on the whole group of connective tissue, while larger doses display an inhibiting effect on the functions of mesenchymal formations. The author of this paper found that with a selection of proper serum doses, the regenerative process in osseous tissues may be retarded or accelerated. Non-union follows an intravenous injection of 0.025 c.cm. of the serum; after an application of from 0.001 to 0.002 c.cm. of the serum the reparative processes are greatly accelerated, and a fully ossified callus develops more rapidly than in control cases.

The author experimented on rabbits, using anti-reticular cytotoxic sheep serum. As control, he employed serum of normal, non-immunized sheep. The specific effect of the cytotoxic serum was clearly demonstrated both in blockage and stimulation of the healing of fractures.

In 28 of 72 patients who received subcutaneous injections of the serum, a marked effect was recorded, a less pronounced effect in 42, and failure in 2. The last 2 patients mentioned were suffering from an inveterate pseudarthrosis. The injections never produced any undesirable effects. They are recommended by the author in cases with a delayed union. The serum was obtained by the author from a horse repeatedly immunized with extracts of spleen and bone marrow from a human cadaver. The serum was diluted ten times with physiological saline solution. In some cases injections were repeated once after four days. JOSEPH K. NARAT, M.D.

**Roth, H.: Concerning Delayed Sequelæ Following Traumatic Luxation of the Hip Joint** (Ueber Spaetfolgen traumatischer Hueftgelenksluxationem). Zurich: Dissertation, 1940.

No uniform opinion exists in the special literature concerning the prognosis of traumatic luxations of the hip joint. This review of the material seen in the Surgical Department of the University Clinic of Zurich from 1919 to 1938, consisting of 41 cases of traumatic hip dislocations including luxation fractures, together with 18 cases of clinical and roentgenological follow-up studies, is directed against the hitherto too optimistic viewpoint concerning the end-results of these injuries.

An absolute restoration to normal, i.e. with no clinical or roentgenological changes, was seen in only

16 per cent of the cases. All of the other cases which were subjected to follow-up study showed changes of all grades, either in the nature of an arthrosis deformans or of an ossifying type (myositis ossificans, para-articular calcifications), or else of a mixed type of both of these forms. Intra-articular associated injuries, especially breaking off of the acetabular margin, were found in 47 per cent of the cases. The prolonged treatment period necessitated by these injuries had a deleterious effect upon the end-result, particularly in the sense of increased deforming joint changes. Difficult or delayed reposition favored the appearance of ossifying processes. This fact indicates that the reposition should be carried out as early as possible and in the most atraumatic manner.

According to the observations made at the Zurich Clinic, the length of the fixation in cases of uncomplicated luxation is of minor importance; intra-articular complicating injuries, on the other hand, demand a sufficiently long period of fixation. In every case, weight-bearing by the injured joint should be withheld as long as possible, i.e., it should not be permitted before two or three weeks in uncomplicated luxations, and at least four weeks in cases associated with intra-articular injuries. This freedom from weight-bearing is best obtained by fixation with an extension dressing. The type of after-treatment appears to be of secondary importance so far as the late results are concerned.

The prognosis in central luxation fractures is to be designated as particularly poor since in the observed cases changes of the deforming type developed in 100 per cent of the patients. As far as the age of the patient is concerned, it was seen that in the group between forty and seventy years of age as well as those between five and thirty years, there was a tendency toward the deforming type of changes, whereas in the age group between thirty and forty years the changes were more inclined to be of the ossifying type. (SCHENK). HARRY A. SALZMANN, M.D.

**Agostinelli, E.: Vertical Traction or Traction at the Zenith in Fractures of the Femur in Children** (La trazione verticale o allo zenith nelle fratture femorali dei bambini). *Policlin.*, Rome, 1941, 48: sez. chir. 45.

Children have a tremendous capacity for repair of bone. Nevertheless, this capacity does not suffice to prevent shortening in fracture of the femur if the fracture is not properly treated. The reason for this is that the shortening comes not so much from comminution of the bone as from muscle traction.

The author describes and illustrates the methods heretofore in use in treating fracture of the femur in children: (1) fixing the broken limb against the trunk; (2) the use of splints which immobilize the leg; (3) continuous traction; and (4) operation. These methods are criticized and his own method is described and illustrated.

In his method the child lies on his back in bed with the injured leg flexed at a right angle to the body with traction applied to the foot. The child is in such a position that it is easy to keep him clean, and the traction is exercised in such a direction as to bring about the desired effect.

Eight cases treated in this way are described and illustrated by roentgenograms showing the perfect alignment attained. AUDREY G. MORGAN, M.D.

# SURGERY OF THE BLOOD AND LYMPH SYSTEMS

## BLOOD VESSELS

**Jorpes, E.: Pure Heparin for the Prevention and Treatment of Thrombosis.**
**Crafoord, C.: Heparin as a Prophylactic Against Postoperative Thrombosis.**
**Wetterdal, P.: The Use of Heparin as a Prophylactic Against Thrombosis Following Gynecological Operations.**
**Leissner, H.: The Use of Heparin in Obstetrical Practice as a Means of Preventing Thrombosis.**
**Clason, S.: Three Cases of Pulmonary Embolism Following Confinement, Treated with Heparin.**
**Bauer, G.: Early Diagnosis of Venous Thrombosis by Means of Venography and Abortive Treatment with Heparin.**
**Lindgren, S., and Wilander, O.: The Use of Heparin in Vascular Surgery.**
**Rosenquist, H.: The Usefulness of Heparin in Combating Arterial Embolism and Thrombotic Complications.**
**Linde, S.: On the Incidence of Thrombo-Embolism Following Surgical Operations, and Its Influence on the Length of the Recumbent Period.**
**Hedenius, P.: The Use of Heparin in Internal Diseases.**
*Acta med. Scand.*, 1941, 107: 107–173.

Though heparin was discovered by Howell and McLean in 1916, its chemistry was cleared up by Jorpes only five years ago, and during the last few years the knowledge of its physiology and clinical applications has been greatly increased. It arises from the mast cells of Ehrlich. These cells show a marked predilection for the neighborhood of the finer blood vessels, and their function is definitely linked with the vascular system.

Heparin is the body's own anticoagulant, which neutralizes thromboplastic substances and assists in keeping the blood fluid. It is prepared from the liver and lungs of cattle. Their low heparin content makes the isolation of it rather difficult. In solution, heparin is stable, and can be boiled for one hour at 100°C. The potency of the commercial is constant. No secondary reactions result from the use of well purified preparations. The most practical method of its administration is to give four routine daily doses, 50 mgm. at 8, 12, and 4 o'clock, and 100 mgm. at 8 o'clock as a night dose.

Care must be taken that heparin is not given to patients bleeding from gastric ulcers or hemorrhoids, and the likelihood of a hemorrhage into the pleural cavity from pulmonary infarcts must always be borne in mind. Menstruation is no contraindication. Any undesirable bleeding may be checked by blood transfusion or, in urgent cases, by the intravenous injection of protamine sulfate, which promptly neutralizes the effect of twice its amount of heparin. Rarely does a serious anaphylactic shock occur on the resumption of treatment that has been temporarily discontinued. This is due to the presence of small quantities of protein. Heparin itself does not produce sensitization. It is advisable, when resuming treatment, to begin with desensitizing small doses.

The coagulation mechanism in the body is influenced by operative trauma, larger quantities of heparin being required to obtain the same prolongation of the coagulation time if it is administered postoperatively than if it is given to the healthy individual pre-operatively. This is the best possible evidence of the increased postoperative tendency to coagulation, and indicates that the use of heparin is physiologically justified.

Crafoord selected for heparin treatment groups of patients suffering from diseases which have shown a relatively high percentage of thrombo-embolic complications. Among 325 of these patients, not a single instance of thrombo-embolism occurred, whereas in the control groups the incidence of postoperative thrombo-embolism was relatively high. It is evident therefore, that heparin is very efficacious as a prophylactic against postoperative thrombosis. As a therapeutic agent, however, it is too early to reach any definite conclusion as to the value of heparin in already existent thrombo-embolism.

In gynecological practice, thrombosis and embolism are likely to occur, particularly after operations for prolapse and tumors of the uterus. One hundred and twenty-seven of such patients were treated with heparin as a prophylactic by Wetterdal, and 20 patients with developed thrombosis and embolism were heparinized as a therapeutic measure. Among the former, only 1 certain instance of thrombo-embolism developed, and it occurred twenty-two days after the operation and eleven days after the cessation of the heparin treatment, while the patient was still in bed. It is advisable, therefore, that the treatment should not be terminated until the temperature is normal and the patient can leave the bed. Among the 20 patients treated with heparin for already existing thrombosis, 6 had pulmonary embolism. All recovered.

In obstetrical practice, only 2 of 50 cases which were heparinized developed thrombosis. However, Leissner administered the heparin for only forty-eight hours after delivery, and the thrombosis appeared much later. In 1 case, a serious uterine hemorrhage occurred. To obtain the full prophylactic effect of heparin, it appears necessary to administer it for much longer than forty-eight hours.

Clason reports 3 cases of pulmonary embolism treated with heparin, all of which were extremely serious, and all of which recovered.

In peripheral thrombosis, a surer and earlier diagnosis can be made by venography than by any other method. With its aid the very first manifestations of the disease in the leg can be discovered. If, at this stage, regular heparin treatment is begun, almost

ideal results can be expected, the whole disease often taking an abortive course. Of 21 such patients treated with heparin all quickly became symptom-free and left bed within a few days. Among 32 patients with similar conditions but not so treated, 2 died, 3 developed pulmonary embolism, and 24 suffered from a spread of the thrombosis to the femoral veins.

The difficulties connected with surgical procedures on blood vessels depend, in the main, on the strong tendency of the blood to form local thrombi at the site of operation and thus obliterate the vessel. Animal experimentation has definitely shown that heparinization prevents this secondary thrombus formation and the vessels remain free. Since heparin prolongs the coagulation time but has no effect on the bleeding time, there is very little danger associated with its use. Bleeding is not increased by heparin. For hemostasis, the vital reaction of the vessel wall, i.e., its capacity to contract, probably plays a far greater role than the process of coagulation. In vascular surgery, heparin should be given as soon as the operation is begun, or, in cases of embolism, as soon as the diagnosis has been established, It should be continued until the patient has left the bed, so that a thrombus need no longer be feared because of the patient's immobile condition. The treatment should not be abruptly discontinued, but the dosage should be gradually decreased. Lindgren and Wilander obtained good results in 10 of 11 cases which they report.

In internal medicine, observations on the value of heparin are too few to justify definite conclusions. In the treatment of thrombosis of the ocular vessels, heparin is very valuable. Favorable effects have been observed in cases of cerebral embolism and thrombosis. Uncomplicated cases of coronary thrombosis are well suited to heparin treatment, but this must be longer and more intense than it usually is.

It is obvious from the reports that heparin is an effective prophylactic anticoagulant, and it is probable that its usefulness in the treatment of thromboembolic disease will greatly increase in the future.

SAMUEL KAHN, M.D.

**Zopff, G., and Engelhard, O.: The Conditions Favorable for Air Embolism after Opening of the Vena Cava Inferior** (Die Bedingungen fuer den Eintritt einer Luftembolie nach Eroeffnung der Vena cava inferior). *Zentralbl. f. Chir.*, 1940, p. 2166.

In the entire literature of the last twelve years there is not one report of air embolism of the inferior vena cava. Elberg collected 90 cases of injury to the inferior vena cava from the literature. In the majority of the cases the tear in the vein could be sutured with success (66 were cured and 24 terminated fatally). He emphasizes the danger of hemorrhage and air embolism, and in regard to the latter recalls a case of Lindner's. He also recalls the work of Frey in 1929, in which 910 authors are mentioned. Hoffheinz also cites Lindner's case. In this case operation was attempted for a tumor of the right kidney—the pedicle and a few centimeters of the vena cava were surrounded by tumor tissue. The distal portion of the vessel had already been clamped, but before the proximal portion could be tied off a murmur set in and within a few moments the patient died of air embolism. This was proved by autopsy examination. The infiltrated carcinoma masses had kept the end of the vessel open and this made a condition favorable for air to enter the circulation.

Borst described a bullet injury of the iliac vein and injury of the small intestine. The gas pressure from the bowel and possibly from air entering at the time of the injury was able to overcome the pressure in the vein and so led to air embolism. At any rate, air or gas will enter the circulation only when the pressure outside of the vessel is greater than that within, or when the pressure in the vessel is lowered by breathing. Long ago Magendie had the right conception that in inspiratory expansion of the chest the blood in the veins is drawn toward the heart. Veins which with inspiration and expiration show a corresponding venous pulse are in danger according to Amusat.

Eppinger's and Hofbauer's experiments and Kuhlenkampf's clinical observations contradict the occurrence of air embolism in leg operations.

The pelvic veins of women deserve special consideration. The examining hand of the doctor introduced into the uterus may increase the pressure already present and so cause air embolism. If the veins are open air is apt to enter and during examination the danger is increased. This knowledge resulted in repudiation of the knee-chest position for obstetrical and gynecological procedures. The extreme Trendelenburg position also favors air embolism; the abdominal content falling against the diaphragm compresses the mesentery and disturbs the peripheral venous flow. A lower than atmospheric pressure is thereby favored. If the levator ani contracts, the arcus tendineus becomes tense and dilates the veins in the urogenital apparatus, and therefore the same dangers are present as in the chest veins.

The "ima-" veins of the thyroid gland are anchored in the mediastinum in such a manner that in injuries they gape readily and allow air to enter; likewise the liver veins with their thin walls, which are so firmly adherent to the liver tissue that they cannot retract in case of rupture. If the blood suddenly sinks in the veins to zero and connection with air exists, hydrostatic laws take effect.

The inferior vena cava possesses a guard against this in that at the moment it enters the chest cavity it receives a considerable influx of blood from the portal circulation. This influx amounts to more than 20 per cent of the entire blood volume. With respiration there is a contraction of the diaphragm and pressure of the liver into the inferior vena cava. Herein lies the protection, even when the peripheral blood supply is deficient. The author proved these points by registering the pressure in the pancreatic

vein on the one side and in the renal vein on the other in dogs. (PLENZ). LEO A. JUHNKE, M.D.

## BLOOD; TRANSFUSION

**Clemens, J.: The Practice of Blood Transfusion** (Die Praxis der Blutuebertragung). *Deutsche Ztschr. f. Chir.*, 1940, 254: 73.

The most noted author in the field of blood transfusion writes from his personal experience in this article. After a general preface on the choice of a donor, in which also is mentioned the selection of the donor with specific immune serum, he refers to the importance of the emergency donor organization within the hospitals; he believes that the blood should be obtained from the mildly sick in preference to the permanent hospital staff. The universal donors, Group O, must always be reserved for use in the most urgent cases. The establishment of a central blood conservation laboratory is welcomed in peace and more especially in war; there are, however, many organization and economic difficulties to be overcome.

The infusion of solutions never takes the place of blood transfusion. Two cases from his experience which confirm this statement are reported. In order to guarantee an accurate blood-group determination a double examination is recommended, first with the serum A, B, and O obtained in the hospital from the laboratory, then by the physician himself with the purchased test sera. In urgent cases compatibility may be tested by simply mixing blood from the donor and the recipient or, even better, by cross-matching. The latter should be done in each case in which the same donor is to be used a number of times for the same recipient, for even when the blood groups are alike or Group O blood is used, defense agglutination may occur, which later leads to unpleasant transfusion reactions. Two examples are cited. Post-transfusion agglutination is discussed; this manifests itself by microscopic and macroscopic rouleaux formation and finer grained clumping; but, of course, occurs only in certain cases. In general, it is believed that if one makes use beforehand of the cross agglutination the same donor may be used repeatedly. The author cannot share the doubts of many authors on the use of the O donor on account of the agglutinating capacity of the O serum; he recommends only not to transfer too great quantities of blood in such cases.

The biological test of Oehlecker with 20 c.cm. of blood and subsequent observation for one to two minutes has kept its value despite the serological blood grouping, but the test may fail in the presence of like groups of blood, and severe transfusion reactions may then appear. Therefore, the larger biological test with about 150 c.cm., instead of the smaller one, is preferred. This, however, offers certain technical difficulties in direct transfusion. As the author uses only the indirect transfusion, and the form with slow transmission, he can profit by the advantages of the "greater test," after sufficient observation of the patient, and interrupt every unpleasant reaction immediately at its start. Moreover, slowly transfused blood is more compatible than blood rapidly given. Should a transfusion reaction occur, the quantity of blood is subject to precise measurement: 100 c.cm. is not very serious, and from 300 to 400 c.cm. a favorable result is to be expected. If a serious reaction occurs immediate venesection with infusion of saline solution, and new, compatible (directly and indirectly examined) blood should be given.

Heart, pericardial, lung, and kidney disease are best excluded in transfusions. In eclampsia transfusion can be tried after blood letting. Allergic patients are especially to be observed.

In conclusion, the author discusses the indirect transfusion methods with the addition of an anticoagulant (sodium citrate or heparin).

(MAX BUDDE). THOMAS C. DOUGLASS, M.D.

**Whitby, L. E. H., Vaughan, J., and Brown, H.: Discussion on the Therapeutic Value of Transfusion of Derivatives of Blood.** *Proc. Roy. Soc. Med.*, Lond., 1941, 34: 257.

Whitby states that transfusions of derivatives of blood may be performed for a large number of reasons which must be clearly defined because almost all of the derivatives lack one or more of the properties of fresh blood and have, therefore, only a limited therapeutic value. The convenience of blood derivatives should not lead to their improper use. War has led to the development of durable blood derivatives suitable for the restoration of blood volume which is essential for the treatment of secondary shock. Stored blood over a certain age must be included in this category.

Experimental evaluation has placed the order of preferment for blood derivatives used for restoration of the blood volume as citrated plasma, serum, hemoglobin-Ringer, gum saline solution, red cells in saline suspension, isotonic saline solution, and glucose. Extensive experience has shown that although citrated plasma is eminently satisfactory, it is an advantage to use a proportion of blood when the volume to be restored is large.

The authors focus their thoughts on conditions of secondary shock and severe hemorrhage which are prominent during this time of war. Transfusion is practiced for the following two main reasons: (1) restoration of the oxygen-carrying capacity, and (2) restoration of the blood volume. Derivatives of the blood are extremely efficient for purposes of blood-volume restoration but quite useless for increasing the oxygen-carrying capacity, with the exception of stored blood. Whitby notes that carefully taken and refrigerated blood to which glucose has been added does not develop serious fragile properties for at least four weeks.

The corpuscles of young stored blood and of fresh blood are suitable for the preparation of concentrated red-cell suspensions for the treatment of anemia when the object is to provide the maximum

increase in oxygen-carrying power rather than increase the blood volume. This procedure is advantageous for those patients with true aplastic anemia who have to lead a "transfusion life" and in whom it reduces the time taken for a transfusion. Such suspensions have a very poor volume-restoring power as judged by experimental results.

The various fluids tried out in resuscitation work are preferred in this order: whole blood, plasma, serum, hemoglobin-Ringer, gum saline solution, isotonic saline solution, and isotonic glucose solution. Citrate plasma, in cases in which the loss to the circulation is due to loss of plasma and so gives rise to hemoconcentration, is recognized as being a more physiological fluid for blood-volume restoration than is blood. For example, in the treatment of 6 cases of burns, citrated plasma has been satisfactory.

In 3 cases of 24 studied, Whitby was impressed by the almost unbelievable amount of blood loss which some patients suffered and still remained alive, the quantitative recovery of the blood pressure as the blood volume was restored, the necessity for the replacement to be not less than 50 per cent of the blood loss, and, for permanent effect, the importance of considering the protein fraction of the transfused fluid. The need of transfusion rarely ended in the resuscitation ward.

Vaughan and Brown analyze the results obtained at the North West London Blood Supply Depot with certain blood derivatives, viz.: plasma, serum, and concentrated red cells. The observations are necessarily qualitative rather than quantitative, since air-raid casualties are rarely suitable for accurate controlled studies.

There appeared to be no marked difference in the reaction rates obtained with plasma, normal concentrated serum, and whole blood. Plasma, serum, and blood appeared equally effective in the treatment of patients with shock. Since some degree of anemia has been found in air-raid casualties, best results will be obtained by the administration of both blood and a protein fluid to such patients. In the case of burns, when hemoconcentration occurs, plasma or serum are definitely to be preferred to blood in the first twenty-four hours. Local edema may be reduced by the use of concentrated serum. In the presence of severe sepsis, fresh blood should be given. Concentrated serum has proved disappointing in the treatment of nephrotic edema.

Dried serum has the following additional advantages: (1) it does not clot, (2) it is not readily infected, (3) it is unaffected by temperature, and (4) it has a small bulk. Concentrated red cells have proved valuable in the treatment of conditions in which it is necessary to raise the hemoglobin without greatly increasing the blood volume. No great difference in the dosage of blood, serum, and plasma has been noted.

Plasma may be prepared in three different forms: unfiltered, filtered, and dried. Unfiltered plasma is obtained by syphoning the supernatant fluid off the red cells after sedimentation has occurred, or by centrifugalization. Filtered plasma is passed through a Seitz filter after separation. Serum is available in three forms: filtered liquid, dry, and as serum citrate prepared from recalcified plasma.

Apart from clinical considerations, serum is certainly an easier fluid to handle in large quantities than plasma, is not readily infected, and does not clot. However, plasma appears an ideal culture medium. If fibrinogen proves to be of any importance in patients with shock, plasma is clearly to be preferred to serum. If high protein content is important, serum is to be preferred.

In conclusion, the three authors state that it is doubtful whether such controlled accurate observations can be made under "blitz" conditions. Possibly severe industrial accidents might provide suitable material for careful investigation.

HERBERT F. THURSTON, M.D.

**Hoxworth, P., and Skinner, C.: Improvement in Blood Transfusion Service. Establishment and Operation of a Blood Transfusion Service. Results of 3,077 Transfusions of Bank Blood; A Statistical Analysis.** *Arch. Surg.*, 1941, 42: 480, 498.

The selection and artificial preparation of high-titered test serums, the study of the cause and prevention of hemolytic transfusion reactions, the consideration of the rôle of subgroups and intragroup agglutinins in transfusion accidents, and the adoption of a simple, accurate technique for the determination of blood grouping and compatibility are described by the authors.

Three ways of obtaining blood are discussed: from the cadaver, the blood bank, and the volunteer donor bureau. Particular emphasis is placed on the blood bank and the method of operation of the one used at the Cincinnati General Hospital. The blood in the bank is maintained constantly at a temperature of from 2 to 4° C. as shown on recording thermometer charts. After the blood is obtained, it is labeled, and on the following morning, it is checked by Kahn, grouping, and matching tests. During one year more than 300 persons having syphilis with no previous knowledge of the disease were found. Separation of the blood of white from that of Negro donors in the bank has been a constant practice for reasons other than scientific ones. As far as is known, no immediate or ultimate effects accompany the transfusion of blood from a person with skin of one color to a person with skin of another.

The adoption of rigid routines in the preparation of solutions and cleansing of glassware and tubing with which the solutions come in contact have reduced the incidence of untoward reactions. Despite careful attention to these factors, the incidence of chills and fever in most reported series of blood transfusions varies from 5 to 20 per cent. In addition to extrinsic factors, it is probably true that the condition of the patient plays a rôle in these reactions.

Whether the incidence of reaction increases as bank blood ages is another subject of much interest.

At present the figures indicate that the aging of blood does not increase the incidence of reactions. In practical operation the great majority of bank blood units given are under seven days of age.

In conclusion, the authors present an analysis of the experience gained and statistics derived from 3,077 transfusions of bank blood at the Cincinnati General Hospital.

1. Blood of the same group as that of the patient is available without delay in 96 per cent of the cases.

2. The incidence of untoward transfusion reactions compares favorably with that in reported series of transfusions of fresh blood.

3. Aging of blood does not increase the incidence of febrile reactions.

4. There is no significant increase in untoward reactions resulting from transfusion of Group A blood as compared with transfusion of blood of the other groups.

5. The causes of loss of bank blood are, in order, positive reactions for syphilis, expirations of the time limit, and clotting. Methods for minimizing these losses are suggested.

6. In the 3,077 transfusions of blood given, only 1 death occurred which might be attributed to the transfusion.

HERBERT F. THURSTON, M.D.

**Jewesbury, E. C. O.: Reactions after the Transfusion of Stored Blood.** *Brit. M. J.*, 1941, 1: 663.

Transfusions of stored blood are being used freely in England at the present time. The incidence of transfusion reactions from stored blood compares favorably with that from fresh blood. A modification of Riddell's Classification of the severity of reactions was used to evaluate some 700 transfusions of stored blood. Grade 1 reactions were those in which there was a rise in temperature above 99 degrees following transfusion but in which there was no other sign. Grade 2 reactions were those with temperature plus shivering attacks and mild chills. Grade 3 reactions were obvious rigors. The total incidence of Grades 2 and 3 reactions was 8.5 per cent. Grade 3 reactions occurred in only 4.1 per cent of these cases. This incidence compared favorably with 700 transfusions of fresh blood which had been given in three large London hospitals during the previous year and in which the average incidence was 7.9 per cent.

The author found that reactions were by no means confined to the blood that had been stored the longest, although the incidence of reaction was slightly increased. Fifty-eight transfusions were given with blood that had been stored for more than twenty-one days; the oldest stored blood used was thirty-three days old and produced no reaction.

Hemolysis of stored blood does not increase rapidly until after the twenty-first day, after which time jaundice and possibly febrile reaction may occur. Therefore, blood stored longer than three weeks should preferably not be used. *In vitro* hemolysis of stored blood is markedly diminished by the use of glucose as a preservative, in which cases the useful life of stored blood may be increased.

HOWARD A. LINDBERG, M.D.

# SURGICAL TECHNIQUE

## WAR SURGERY

**Cope, V. Z.: London Under Air Bombardment; Some Medical Aspects.** *Brit. M. J.*, 1941, 1: 523.

As a result of the extended aerial bombardment, such factors as disturbance of routine, shortened sleeping time, poor ventilation in some of the shelters, and interference with essential services, especially water supplies due to broken mains, have been involved in affecting communal health. Cope urges greater use of rain water collected in tubs or tanks from roofs against sudden shortage. Transportation has been conspicuously uninterrupted.

A surprising complication of the unforeseen necessity for sleeping accommodations in shelters was thrombosis of the deep leg veins, which resulted from continuous pressure with relaxed muscles against improvised deck chairs, and the concomitant increase in the number of sudden deaths from pulmonary embolism. Lack of toilet facilities in certain shelters, coupled with prolonged stays, accounted for a great increase in urinary retention among old men. Increase in sleeping and toilet facilities has been a successful remedy. To prevent the spread of droplet infection in crowded shelters, the wearing of surgical masks has been introduced. Cope decries the fact that this method of prophylaxis has not been extended on a large scale to industry to help reduce the enormous work time lost annually from colds. The casualty lists, while unpredictably small, are striking for the high proportion (about 40 per cent) of fatal injuries. The explanation of the high fatalities is found in the varying ages and states of health of the victims; the injuring of vital parts by crushing under fallen debris; asphyxia from burial, clouds of dust, or escaping gas; the risk of fatal burning in ensuing fire or steam from open pipes; and the effect of severe shock induced by pressure of heavy structures pinning down the victims.

Injuries from broken glass, while frequent, were serious only if the fragments were numerous enough to cause anemia from extensive bleeding or if they were large and embedded in body cavities. Numerous smaller fragments were left alone usually, their removal being impractical or impossible.

The severest lesions by far were the injuries due to the crushing of bodies or limbs by great masses of debris. Pressure continuing for hours causes an amount of shock so great that the vitality was depressed to the limit of endurance, or beyond it. A new form of intestinal injury, multiple points of gangrene on the coils of the intestinal wall from prolonged pressure, with resultant peritonitis, is described. Also, it has been observed that sudden impact against the abdomen in blasting may cause serious intestinal injuries.

Blood pressure and pulse pressure have been found to be the most reliable measurable factors in the recognition of shock, though specific gravity of the peripheral blood and measurement of the blood volume are accurate if available. Rest, warmth, morphia, and blood and plasma transfusions were effective in counteracting shock.

The immediate medical treatment of casualties fell into the lot of mobile units, dispatched to the scene of incidents, and the first aid posts. The more serious cases were sent on by these to the nearest hospital. The London experience supports Trueta's view that first-aid posts should be held in or attached to an adequately equipped hospital. Bombing has disrupted general medical practice, diminished the number of available beds in central hospitals, and interfered with the regular clinical teaching of medical students in hospitals. EDWIN J. PULASKI, M.D.

**McKissock, W., and Brownscombe, B.: Apparently Trivial Head Injuries; Preliminary Treatment and Examination; Results and Pathology; Practical Points in Treatment.** *Lancet*, 1941, 240: 593.

A group of 53 patients, all of whom had received apparently trivial head injuries, were statistically analyzed by the authors. Many of these patients had scalp wounds, and there was a history of unconsciousness produced by trauma in all of them. In none of them, however, was there roentgenographic evidence of skull injury.

Operation (apparently scalp suturing) had been performed in 27 of the patients before the authors saw them, but healing had occurred in only 2, and many of the wounds were suppurating. The authors attribute these poor results to retained foreign bodies, lack of extensive scalp shaving, and closure of the wounds with through-and-through gut sutures.

Abnormally raised or lowered intracranial pressure (as measured by lumbar puncture) was found in 19 cases; blood was present in the C. S. F. in 16; and 41 individuals showed abnormal signs referable to the central nervous system, such as pupillary, motor, reflex, or mental changes.

The authors did not hesitate to perform lumbar puncture as they are of the opinion that this does not result in increased intracranial bleeding: in fact, lowering the pressure may reduce the venous pressure and thereby reduce bleeding.

The patient with these head injuries should be made comfortable and treated for shock for the first twenty-four hours after injury. Intracranial pressure should be maintained at a normal level by regulation of the fluid intake through elimination of fluid by way of the bowel with magnesium sulfate enemas, and the judicious use of lumbar puncture.

The authors believe that a first-aid dressing only should be applied at the time of injury, and subsequent care should be given when adequate facilities exist. The scalp wound should be widely shaved and

cleaned, and the damaged tissues and foreign bodies excised. The galea and skin should be sutured in two layers with silk sutures.

Of the 53 cases analyzed, all showed complete recovery as far as neurological findings were concerned. LUTHER H. WOLFF, M.D.

**McIndoe, A. H.: Surgical and Dental Treatment of Fractures of the Upper and Lower Jaws in War Time. A Review of 119 Cases.** *Proc. Roy. Soc. Med.*, Lond., 1941, 34: 267.

The author points out that the causes, distribution, and varieties of fractures of the jaws and their associated complications in war time differ greatly from those seen in civilian practice, and that these fractures have presented many new problems. The communication deals with the surgical and dental management of 119 cases of fractures of the upper and lower jaws which have been treated in an E.M.S. maxillofacial unit. As might be expected, a considerable portion of the patients had associated injuries, such as tissue lacerations and fractures of other bones. The following table gives the classification of the material:

| | |
|---|---|
| Total number of patients with fractured jaws | 119 |
| Total number of patients with fractured jaws, but without other injuries | 68 |
| Total number of patients with fractured jaws, with other injuries | 51 |
| Fractures of the mandible | 82 |
| Fractures of the maxilla | 37 |
| Fractures of the mandible and maxilla | 7 |

A large percentage of the patients were fit young men on active service between eighteen and thirty-five years of age, but, on account of the bombing of the civilian population, females (18 per cent) and older people, varying in age from six to seventy-two years, were among those injured. Many of the accidents occurred in patients sitting quietly at home. The cause of the injuries as can be expected was extreme violence. Only 18 were from blows, kicks, and falls. Bomb and mine explosions and penetrating missiles accounted for 45 per cent: in many cases there was severe facial injury with localized but great bony damage. The collapse of buildings which caused the patient to be struck by a mass of masonry, or hurled head first onto it, produced 13 per cent. Head-on crashes in airplanes, automobiles, and motorcycles were only second to the effect of high explosives, namely, 36 per cent. In this group, there was a maximum of bone damage and displacement with a minimum of soft-tissue injury. The second table is a classification of the causes of the 119 injuries.

| | |
|---|---|
| Bomb and shell fragments; mine explosions | 45 |
| Gunshot wounds (Mostly penetrating or perforating wounds and fractures) | 9 |
| Collapse of buildings | 16 |
| Motorcar and motorcycle collisions | 23 |
| Plane crashes (Mostly severe comminuted fractures with gross displacement) | 8 |
| Blows and kicks | 9 |
| Falls (Mostly localized fractures without external wounds) | 9 |

In general it may be said that the excessive violence of most of the trauma tended to produce a much more severe bony injury than that encountered in civil life. Seventy per cent of the mandibular fractures were double, multiple, or comminuted. In 12 per cent, bone grafts were or will be necessary. The incidence of unilateral and bilateral condylar fractures is significant. The maxillary fractures were mostly due to head-on crashes and other forms of extreme violence. The number of "middle-third facial" crush fractures was comparatively small (5), that is, fractures in which the entire nasal maxillary compound was thrust bodily backward into the face.

The writer points out that a careful clinical examination is of importance and that x-rays should be taken from various points of view, including a view of the whole head, and rotating views of the lower jaw to include the temporomandibular joints.

The treatment of these injuries differs considerably from that adopted in similar injuries in other parts of the body. Because of the good blood supply and the well-known resistance to infection, radical excision of the damaged tissues and removal of foreign bodies need not be performed at the earliest moment to avoid sepsis and gas gangrene.

Co-operation and teamwork in dealing with facial injuries, and the construction of splints for the reduction of fractures is stressed. The soft tissue injuries are treated in two different ways, in which the time factor plays a role in relation to possible infection. Facial injuries seen within the first twelve hours may be sutured with impunity, providing great care is taken to cleanse the wounds thoroughly with soap and water and saline solution, and to remove thoroughly all foreign bodies and dirt. After twenty-four hours suturing is not advisable, for the risks of sepsis rise steeply. After this time the wounds should be packed open with saline gauze which is changed frequently. The author states that it is remarkable how well a facial wound packed widely open with saline gauze will heal in the absence of all tension, and how rapidly a breakdown will occur under the reverse conditions. Comparatively little scar results from this procedure, but the subsequent removal of the marks of badly placed sutures, which have cut in, is far from easy.

Drainage of all compound injuries of the jaws associated with external wounds is important at whatever time they are seen. Rubber tubes of sufficiently wide bore are recommended. Shepherd has devised an effective method of saline drip irrigation through a catheter to be used in wounds with small points of entry and exit but with severe damage within the mouth. The saline solution is run in from time to time from a flask type of irrigator controlled by the patient himself.

The fractures of the mandible are treated with permanent immobilization of the fragments, the clearing up of sepsis in the fracture lines being the ideal to be aimed at. The methods of immobilization are by means of (1) interdental eyelet wiring, (2) intermaxillary arch wiring, and (3) cast-metal cap splints. The reasons that the author believes that the latter are best suited are (a) they give positive fixation and stable immobilization; (b) they can be modified in many ways to make them useful for all edentulous cases; (c) there are no wires to break or readjust; (d) in certain fractures of the lower or upper jaws a single rigid splint is sufficient and mastication is not interfered with; (e) with the use of locking devices and hooks, many problems difficult of solution with wiring methods can be overcome; and (f) cap splints do not harm the gums.

To control sepsis, teeth in the fracture lines are removed except when a single tooth remains on a fragment. It is then retained as long as it is of value for immobilization. Pieces of bone are retained if they have a chance of survival, except in cases with extensive loss of bone, in which bone grafting is inevitable. Unerupted third molars lying in fracture lines are retained until sufficient consolidation has occurred to make removal safe. The splints are so constructed that questionable teeth can be removed later without disturbance. This conservative treatment of bone fragments leads to the extrusion of sequestra, and, if purulent discharge persists, the fracture cavity is curetted and dead fragments of bone are removed. The following figures are instructive as to the presence of sepsis:

| | |
|---|---|
| Mandibular fractures with perforating wounds—all drained | 34 |
| Mandibular fractures without perforating wounds—no abscess, no drainage | 42 |
| Mandibular fractures without perforating wound—abscess requiring drainage | 6 |

In simple fractures the splints are removed after from four to six weeks and the mandible is tested for union. If union has failed to take place, the splints are reapplied for a further four weeks. Consolidation may take a considerable amount of time, sometimes three or four months in the case of perforating wounds with extensive comminution.

Fractures of the maxilla require early disimpaction and immobilization. Unilateral maxillary fractures are disimpacted with the fingers and immobilized by means of a complete cap splint. Bilateral maxillary fractures constitute a much more serious problem. Both horizontal fractures, those including only the alveolar part with the palate, and those in which the entire third of the face is thrust bodily backward between the malar bones into the ethmoid region, should be disimpacted at once. This is of great importance because reduction becomes extremely difficult as consolidation occurs.

Immobilization depends on the finding of a point of resistance by splinting the lower teeth with full upper and lower cap splints and by upward traction with a Kingsley type of splint and plaster head cap. If the antra are also crushed, a rigid type of external fixation in head gear is essential. Still more difficulties are encountered when the nasal and malar bones are involved. In these cases constant external traction by means of wires or elastic bands attached to bars projecting from a head cap have been found to give good results.

The author also gives some space to surgical complications and sequelæ of fractured jaws. Non-union entails a search for such factors as sepsis, sequestra, teeth in the fracture line, and inadequate immobilization. Malunion may mean surgical division of the fracture and resplinting in correct position. To do this in the lower jaw, a Gigli-saw passed around the site of the fracture, dividing the jaw transversely, is recommended. In the maxilla, the approach to the fracture lines is made through the upper buccal sulcus. After division with chisel and hammer, and cutting through the fibrous adhesions, it is possible to bring the displaced part into normal position, and, by means of external elastic traction or weight and pulley, the jaw is held in position.

Soft-tissue deformities entail the removal of scars or the repair of extensive tissue losses. These operations are undertaken only after the fracture has healed soundly. Microstoma, which results from associated burns, sometimes makes an early operation necessary in order to perform the initial oral work. Repair of the buccal sulcus is often needed so that well-fitting dentures can be applied. Ridge extension or skin grafting has been found helpful in such cases.

Ankylosis of the joints, particularly in cases of condylar lesions, involves one or both temporomandibular joints. In some cases it becomes necessary to resect one or both condyles, including half an inch of the mandibular neck, to form a false joint. The condylectomy is followed by fixation of the jaws for one week, after which the exerciser is used to regain movement.

Bone grafting, which is necessary in 12 per cent of the cases, is not undertaken until from four to six months have elapsed from the last signs of sepsis. The use of iliac-crest bone grafts was found to be eminently satisfactory and has entirely supplanted other methods. Bone from this source is tough and can be bent and shaped: it is highly osteogenetic and is easily obtained in amounts sufficient for the smallest or the largest bone graft without difficulty to the patient. The grafts, after shaping, are wired accurately between the exposed fragments with stainless steel ligatures. Union should be firm in four weeks and movement can then be allowed.

KURT H. THOMA, D.M.D.

**Coleman, C. C.: War Wounds of the Nervous System.** *Ann. Surg.*, 1941, 113: 712.

The purpose of this communication is to recall briefly the principles of treatment found to be effective in the management of wounds of the nervous system in the First World War, with some discussion

of the advances made through the application of these principles to similar injuries in civil life.

Among the 174,296 battle injuries in the American Expeditionary Forces reaching hospitals, the head alone was involved in about 6 per cent, and of these, about 11 per cent resulted fatally. The delay in surgical treatment of penetrating wounds of the head, and lack of unanimity of opinion as to the best method of treatment were important factors in the mortality of casualties involving the head alone in the early period of the war. Another important factor was the frequent association of severe injuries in other parts of the body. In the early part of the First World War the operative mortality of gunshot wounds of the brain was about 60 per cent. This was reduced to about 28 per cent by the operative methods advocated by Cushing. There have been no important modifications of his technique of operation for gunshot wounds of the brain in warfare or in civil life since it was first proposed.

Prompt transportation by airplane of soldiers with gunshot wounds of the head in field operations has been successfully used in some of the countries now engaged in war but open wounds of the brain do not well tolerate elevation of more than 5,000 feet. Experience has shown that patients with head injuries, when not in shock, stand ordinary transportation very well; this also applies to patients in good postoperative condition. While every effort should be made to provide early operation for penetrating wounds of the brain, a delayed operation at a station or hospital where complete surgical treatment can be provided is much better than an early inadequate operation.

It is highly desirable that open wounds of the brain should be operated upon within sixteen hours, if possible. However, many cases may be operated upon to advantage as late as forty-eight hours or more, if obvious infection is not present. It is reasonable to expect that chemotherapy, promptly instituted in penetrating wounds of the brain, will increase the number of cases that may be benefited by later operation, and that the incidence of severe intracranial infection will be reduced by chemotherapy in all cases.

The treatment of head wounds at First Aid Posts should be limited to the control of external hemorrhage, treatment of shock, shaving the scalp, and irrigation of the wound with saline or Ringer's solution, followed by the application of a sterile dressing and the administration of prophylactic tetanus antitoxin and some of the sulfonamide compounds. No effort should be made to remove bone fragments or other débris unless it lies loosely in the wound.

When the patient with a penetrating wound of the head has been placed under conditions suitable for complete investigation, careful neurological examination should be made, and the entire head shaved. Restless patients may be given morphine preliminary to the use of local anesthesia by novocaine injection of the scalp. Local anesthesia should be employed in every case if practicable. Sometimes the treatment of shock and the intracranial operation may be carried out simultaneously.

The fundamental objective in the treatment of penetrating wounds of the brain is the prevention of infection. Disinfection of a penetrating wound is accomplished by copious irrigation of the wound with saline or Ringer's solution, excision of the edges of the scalp wound, and careful removal of bone fragments, macerated brain tissue, blood clot, and foreign bodies whenever practicable. Chemical disinfection of fresh wounds should be discontinued in view of the superior results from mechanical disinfection with large quantities of saline solution. Macerated brain tissue is removed by irrigation through a catheter attached to a bulb syringe, supplemented by gentle suction through a bent glass tube attached to the suction tip. By the use of irrigation and suction, alternately, the macerated brain tissue, blood clot, and foreign bodies may be removed. Great care must be exercised in following the track of the bullet, in order to prevent further injury to brain tissue, and, in many cases, to avoid penetration of the ventricles. All foreign bodies should be removed when accessible, provided this is compatible with the protection of important functional areas. Bleeding vessels may be drawn up into the suction tip and coagulated with the electrosurgical unit, under direct inspection, made possible by the use of the lighted spatula. After thorough cleansing and complete hemostasis, the brain defect is filled with Ringer's solution. The dura should be closed securely without drainage unless there is some doubt as to the completeness of disinfection. The scalp is closed in layers, with interrupted fine silk sutures. Drainage of the scalp wound is unnecessary.

When there is evidence of infection the operation must, of necessity, be a limited one. Easily accessible bone fragments may be removed, the opening in the dura enlarged, and drainage provided. The scalp wound should be packed with vaselinized gauze, and not sutured. The resulting brain fungus should be protected by a rubber dam over which is placed a doughnut ring of gauze.

The prevention of infection by thorough removal of devitalized brain tissue, blood clot, and foreign bodies will minimize the subsequent scar-tissue formation, and thus decrease the chances of epilepsy.

The surgical management of compound fractures of the skull with dural laceration is similar in principle to that of penetrating gunshot wounds of the brain.

In all types of spinal injuries, proper handling of the patient is of greatest importance, in order to avoid damage of the cord or increase of the damage of an existing cord injury. Penetrating wounds of the spine may require operation for the purpose of disinfection or for the removal of the penetrating agent in partial lesions of the cord. The cord lesion may be physiologically complete from the concussional force of the penetrating missile even though the cord itself has not been hit. In many of such cases func-

tion is recovered in a short time with little residual impairment, while in others the cord may be completely disintegrated by the concussion. Practically all that can be accomplished by operation in gunshot wounds of the spinal cord is the disinfection of the wound and removal of fragments of bone and foreign bodies which rarely cause compression.

Before the primary operation for repair of deep wounds of the extremities, a neurological examination should be made, in order to determine whether there is involvement of important nerves. The disinfection and débridement of such wounds, when nerve impairment is probable or evident, should be undertaken by those competent to expose, identify, and suture a divided nerve at the time of the primary treatment of the wound. Early suture of a divided peripheral nerve is desirable. Chemotherapy may be utilized to prevent or retard infection.

In patients with paralysis of a peripheral nerve, in whom the condition of the nerve was not ascertained at the time of the repair of the wound of the extremity, the type of nerve lesion should be investigated at open operation as soon as the local condition of the wound will permit. It is advisable to wait three months after healing of an infected wound before exploration and suture of the nerve are done, but it is important that infection be eradicated as early as possible so that later suture may not be delayed longer than absolutely necessary. If infection develops after primary suture of a nerve, it is often advisable to excise the suture line and resuture the nerve after the infection has been eradicated. Peripheral nerve lesions are often associated with injury to important blood vessels of the extremities, and this, undoubtedly, contributes to unsatisfactory end-results.

Physiotherapy and proper splinting are essential adjuncts to the successful treatment of peripheral nerve injuries. To obtain the best results, both should be started early and continued through the period of paralysis.

The use of autogenous transplants to bridge wide defects in peripheral nerves, has been, so far as the author knows, unsuccessful in every case

The facial nerve is sometimes paralyzed by gunshot wounds of the mastoid region. Facial paralysis resulting from such wounds usually requires anastomosis with another motor cranial nerve. The hypoglossal is preferred for this anastomosis. Traumatic lesions of other cranial nerves do not require surgical treatment.

Further research is needed on nerve transplantation, particularly in view of its almost universal failure in peripheral nerves and the good results claimed for transplantation in facial nerve defects. It is also important to have further information on the relative effects of early and delayed suture in the final recovery of function, and on the length of time after which no further benefit can be expected from surgical treatment of divided nerves. The technique of nerve repair, the treatment of neuroma in continuity, the effects of neurolysis—all present problems which are by no means settled and are worthy of further study. SAMUEL H. KLEIN, M.D.

**Osborn, G. R.: Pulmonary Concussion ("Blast").** *Brit. M. J.*, 1941, 1: 506.

Pulmonary concussion is defined as a hemorrhagic lesion of the lungs caused by the blast of a high explosive in a confined space such as a house or shelter. The increase in positive pressure by the detonation compresses the chest and abdominal walls and results in rupture of the pulmonary alveolar capillaries. In addition, there may be rupture of the goblet cells in the bronchi and bronchioles which yields a bloody mucoid expectoration. Pleural involvement or rib pathology need not occur. In some cases, the abdominal component of this explosive force produces a characteristic basal injury to the lung described as a phrenicocostal sinus pneumonia. Associated with the latter, there is always a tear in the liver or spleen. The severity of the lesion depends on the age of the patient, the rigidity or flexibility of the chest wall, the respiratory position of the lungs, and the amount of protective clothing worn. The younger the patient the more easily compressible the thorax, hence the greater the degree of pulmonary concussion. External evidences of trauma are usually not visible on either the chest or abdominal wall. Pulmonary hemorrhage is not progressive but shock is rapid in appearance. Pulmonary concussion with its other manifestations should be suspected in all patients suffering from the effects of a high pressure blast.

BENJAMIN G. P. SHAFIROFF, M.D.

**Ogilvie, W. H.: Wounds of the Knee Joint; Wounds Seen Within Six Hours; Wounds Seen Later; Sepsis; Closed Plaster.** *Lancet*, 1941, 240: 471.

Synovial folds of the knee joint can limit the spread of infection unless broken down by movement or tension. Any form of immobilization of an injured knee from the earliest moment is the prime factor of success unless infection has been prevented or defeated. The only material which gives 100 per cent immobilization of the knee is the plaster spica. The plaster cast must immobilize well enough, far enough, and long enough. It can immobilize well only if it is skin tight over the greater part with no more padding than a little thin felt over the vulnerable bony points.

Before operation every case should be x-rayed to locate any foreign bodies.

The majority of the penetrating wounds of the knee joint are without bone injury. For wounds seen within six hours, operation is carried out while using a tourniquet proximal to the wound and the strictest aseptic precautions. The wound track is excised in one piece. The knee cavity is irrigated thoroughly. Primary suturing has been found to be more disastrous than successful, yet primary suturing should be carried out when possible because a drained knee nearly always means limited movement.

Cases with injury to the patella or partial injury to other bones should be operated upon immedi-

ately. Splintered patellas are usually removed completely.

Complete fractures of the tibia or femur complicated by injuries to vessels or nerves ordinarily demand primary amputation. An injury to the head of the tibia is usually more serious than one of the femoral condyles.

Wounds of the knee joint which are received between six and twenty-four hours after their primary injury can be débrided; others are frankly infected. The joint is washed out with a weak antiseptic solution: afterward the whole cavity is packed with vaseline gauze and the limb immobilized in a plaster spica, and the patient is put on a course of sulfanilamide. After twenty-four hours, the time for débridement has passed. A man who is doing well looks well and feels well. Pain is the most important single symptom. Aspiration in many instances will make the diagnosis clear: this depends upon whether the fluid is clear or opalescent. Some blood is to be expected, although hemolyzed blood is of grave importance and suggests a streptococcal infection.

The use of extension on the knee by means of weight removes the pressure from the cartilages, but in doing so tends to open the joint which prevents localization of the infection, and encourages the spread to the condylar pouches.

In actual practice, the dressing of large sensitive surfaces proved very exhausting to the patient. Irrigation by means of Carrel tubes did not give the satisfactory results which were obtained by packing the cavities with vaseline gauze and immobilizing the limb with plaster. The Carrel method is too elaborate for use in military surgery under the conditions prevailing at present.

RICHARD J. BENNETT, JR. M.D.

**Bigger, I. A.: Peripheral Vascular Injuries.** *Ann. Surg.*, 1941, 113: 677.

Peripheral vascular injuries involve both the arteries and veins, but the arterial injury is more important, for, because of the high arterial pressure, hemorrhage is more profuse and more difficult to control. Also, obstruction to the flow of blood through a main artery is more apt to produce serious damage to the tissues than is obstruction of the return flow in the concomitant vein.

When a large vessel of the trunk, either artery or vein, is injured, fatal hemorrhage frequently occurs because the vascular wound usually communicates directly with one of the body cavities. Perforation of a large peripheral vein usually communicates with the surface by a narrow channel and, therefore, results in only moderate blood loss, for shifting of the muscle planes obliterates this channel and traps the blood in the tissues, which produces a rapid rise in the extravascular pressure and prevents further bleeding. Bleeding from a peripheral artery may be controlled in the same way, but a higher extravascular pressure is necessary to control the arterial bleeding and this may produce serious obstruction to the blood flow distal to the injury.

The treatment of vascular injuries depends upon many factors, such as the vessel injured, the presence of persistent or recurrent hemorrhage, the condition of the distal circulation, the general condition of the patient, and the available facilities. Bleeding from large vessels may be controlled by the application of ligatures, by digital pressure, or by a tourniquet.

Early operation is indicated if there is continued or recurrent bleeding, inadequate circulation distal to the wound, or a large amount of devitalized tissue. Superficial infection is an indication for delay because the entire operative field is apt to become infected if operation is performed under such circumstances.

Vascular suture, with maintenance of the lumen of the main artery, is the ideal procedure. The following objections have been advanced: (1) it is more time-consuming, and, because of the necessity for prolonged anesthesia, is probably more shocking than ligation; (2) it requires more refined instruments and suture material, which are not always available; (3) if gross infection occurs, the danger of secondary hemorrhage is increased; and (4) the vascular damage is often so extensive that direct suture is not practical.

The danger of severe infection and secondary hemorrhage is reduced by the systemic and local use of the sulfonamide derivatives. The only objection to the local use of sulfanilamide powder is that it increases bleeding.

When suture of an artery is not feasible, ligatures must be applied and the vessel divided between them. Silk is especially indicated under such circumstances, and large ligatures should be used for large arteries, as the larger ligatures are less likely to cut through.

Ischemic gangrene is apt to follow sudden obstruction of the popliteal, common femoral, carotid, and axillary arteries. When one of these arteries is obstructed, every precaution should be taken to prevent circulatory insufficiency. Measures to be considered in this connection are listed below in the order of their importance: (1) sympathetic nerve block; (2) prevention and control of infection; (3) occlusion of the concomitant vein; (4) position of the involved extremity; (5) avoidance of undue pressure; (6) local temperature control; (7) the pavaex machine; and (8) other measures, such as restoration of the blood volume and cell content, nicotinic acid, and papaverin.

In concluding, the author states that when important arteries are occluded, certain measures should be employed to combat ischemia, among them, ligation of the concomitant vein or veins, and sympathetic nerve block. The latter is especially valuable and should be undertaken immediately if there is any evidence of insufficient collateral circulation. In addition to these local measures, certain general measures must also be given consideration. The most important of these is blood replacement.

HERBERT F. THURSTON, M.D.

**Blalock, A., and Mason, M. F.: Blood and Blood Substitutes in the Treatment and Prevention of Shock; With Particular Reference to Their Uses in Warfare.** *Ann. Surg.*, 1941, 113: 657.

The authors discuss the use of blood and blood substitutes in the treatment and prevention of shock. It is generally agreed that the single most effective method for combating shock lies in supplementing the reduced blood volume by the intravenous introduction of fluids. This article deals mainly with wound shock in which there is a decrease in the blood volume due to the loss of whole blood or plasma or both. The consequences of this reduction of blood volume are an inadequate venous return to the right side of the heart, a decline in the cardiac output, a fall in the blood pressure, and stagnant anoxia.

The fluid loss in the early stages of peripheral circulatory failure is mainly local, at and near the site of injury. The general loss of plasma usually does not occur until after the reduced blood volume and pressure and the associated anoxia have resulted in a general increase in capillary permeability. The best means devised for preventing or combating this general increase in capillary permeability in secondary shock consists of the introduction of adequate quantities of whole blood or plasma.

The ideal treatment of shock consists of replacing fluid at the earliest possible moment in the form in which it has been lost. This ideal is not always obtainable and less effective means of therapy may be necessary. Replacement of lost fluids may be accomplished by giving isotonic solutions of salt or glucose, hypertonic solutions of crystalloids, gum acacia, gelatin-saline, hemoglobin-Ringer, whole blood (fresh or preserved), liquid blood plasma or serum, or dried plasma or serum.

Isotonic solutions of salt or glucose are of much greater value in the prevention of, than in the treatment of shock. Solutions of crystalloids are not satisfactory and acceptable blood substitutes in the treatment of shock. Gum acacia ranks next to blood plasma or serum; however, it is less effective and more dangerous than either plasma or serum. There are many objections to the use of gelatin-saline and hemoglobin-Ringer solutions. Administration of large amounts of whole blood in the treatment of shock even when accompanied by hemoconcentration is not contraindicated.

Liquid blood plasma and serum are the most useful of all fluids in shock therapy. They are distinctly valuable from the point of view of nutrition, the protein of these fluids being readily available for catabolism as a source of energy. Nitrogen balance may be maintained even in a starving animal by transfusion of adequate amounts of these fluids, and these fluids are more effective than whole blood in this respect.

The choice of whether plasma and serum should be used in the concentrated or unconcentrated form should depend on the nature of the injury. If the plasma volume is markedly diminished and the tissues are dehydrated, the use of the unconcentrated form appears to be indicated. Plasma and serum are free from reaction-producing substances, are physiologically and therapeutically identical, and may be used interchangeably.

The problems related to the collection, preservation, transport, and dispensation of whole blood and plasma have been discussed with special consideration to military operations. The limitations of whole blood are accentuated under conditions of warfare, and the more readily preservable plasma is better adapted to cope with these complications. This is true particularly of dried plasma which may be preserved indefinitely at uncontrolled temperatures. The length of time that sterile liquid plasma may safely be kept unrefrigerated is not yet satisfactorily established, and may be limited. In civil life, dried plasma can be made available in communities remote from blood banks, or where direct whole-blood transfusion is inconvenient or impractical. Dried plasma is expensive. Sterile distilled water must be available where it is used. Some time is required for it to go into solution. However, the dried form will remain superior to liquid plasma until the problem of permanent preservation of liquid plasma is solved.

In the treatment of traumatic shock the primary objective is the restoration of the blood volume which has been reduced in consequence of hemorrhage, or loss of plasma locally at the site of injury or generally as a result of increased capillary permeability. Only whole blood or plasma may safely, effectively, and permanently restore the volume of the circulation, and of these plasma is preferable because a unit volume supplies more osmotically active protein than does whole blood. The whole blood is essential only in the presence of profound anemia.

Investigations on the intravenous injection of animal plasma are encouraging but have not yet progressed beyond an experimental stage.

In concluding, the authors state that the program of medical preparedness should include the organization of a number of well-equipped units in various cities throughout the country for the collection and preservation of whole blood and plasma. Emphasis should be placed upon the development of more efficient and less expensive means of preparing dried plasma, upon improving the preservation of liquid plasma and, possibly, whole blood, and upon the development of animal plasma, or other protein substitutes for these. HERBERT F. THURSTON, M.D.

**Ross, J. A., and Hulbert, K. F.: Treatment of 100 War Wounds and Burns.** *Brit. M. J.*, 1941, 1: 618.

An analysis of the treatment of 100 war wounds, the majority admitted within six hours of injury, is presented. Many of the injured were airmen and nearly all required anti-shock measures on arrival. In addition to the usual treatment, blood or plasma was given in certain cases. When salines were indicated, the intramuscular route for injection was pre-

ferred, to eliminate the risk of pulmonary edema. Wounds of the limbs constituted the greatest number of cases, the majority being compound fractures. Excision in early cases, and débridement in late cases followed by reduction under fluoroscopy, packing of the wound lightly with acriflavine-paraffin gauze, and immobilization in plaster-of-Paris for about two weeks lessened the incidence of infection in wounds and aided in the resolution of infection if it had set in. Multiple minute puncture wounds were simply painted with $TrI_2$ or gentian violet and let alone, without dressings. Through-and-through-bullet tracks were let alone unless bone or large vessels were involved.

Thorough preliminary cleansing of burns under anesthesia followed by the silver nitrate-tannic acid-gentian violet treatment again proved successful.

Chemotherapy is not considered necessary as a routine measure in the treatment of early wounds occurring in areas where the soil is not heavily contaminated with anaerobic organisms. Its best use is as a prophylactic agent in large wounds which it has not been possible to clean completely. The local application of sulfonamides was not tried. Chemotherapy in one case of anaerobic infection was of no benefit and amputation of the involved limb was eventually necessary. All cases had anti-tetanic serum and no case of tetanus was seen.

Pentothal sodium administered intravenously has proved a safe and satisfactory agent for routine use in war surgery and especially with gas-oxygen as a supplement. All patients were given morphine prior to anesthesia, if possible, and 1 gr. of phenobarbital b.i.d. for several days afterward, with excellent results. The use of local anesthesia in the treatment of war wounds is strongly deprecated.

EDWIN J. PULASKI, M.D.

**Colebrook, L., Lewis, E. E., Mowlem, R., Fleming, A., and Others: Discussion on Chemotherapy and Wound Infection.** *Proc. Roy. Soc. Med.*, Lond., 1941, 34: 337.

This article consists of a series of abstracts from a symposium on chemotherapy of wound infections presented by the Royal Society of Medicine. All participants are at the present time actively engaged in the treatment of war injuries. Colebrook, in opening this discussion, stresses the fact that the sulfonamides are extremely diffusible throughout the body tissue and are the only known group of antiseptics which not only have a direct effect on most of the bacterial contaminants of wounds, but which also maintain their bacteriostatic effect for many hours when placed directly into the wound. All other antiseptics rapidly lose their bacteriostatic properties when placed in contact with blood or tissue fluid. Experimental evidence seems to have verified this statement. Wounds were made in guinea pigs and then infected with 10,000 lethal doses of clostridium welchii and clostridium septique. Sulfathiazole inserted at the same time as the bacteria saved 75 per cent of these animals.

Clinically it is hoped that gas-gangrene infections may be prevented in war wounds by the early direct application of the sulfonamides. If these drugs do have this bacteriostatic effect the safe period for surgical exploration and primary suture may be markedly prolonged. Already there is clinical evidence to show that compound fractures may be safely placed in closed plaster casts after a thorough application of sulfanilamide to the wound.

It was generally agreed that the sulfonamides should be applied directly onto the wound and worked in with the finger or a spatula until a thick uniform layer is obtained. After the first application of sulfanilamide the wounds are not inspected until after the fifth day, at which time the majority are of healthy appearance and there is a surprising absence of infection. Burns are treated by the same technique. In all cases of wounds or burns, soap and water cleansing is first used and primary débridement is carried out before the dressing is applied.

The use of the sulfonamides in skin grafting was also stressed. It was pointed out that before the new technique was used the percentage of failures of take in large skin grafts was extremely high. Five English surgeons using the same technique for the preparation of wounds with adequate cleansing and pressure dressings for many days and weeks grafted 300 cases. Only 16 per cent of these cases gave a 100 per cent take, an additional 27 per cent showed a 75 to 100 per cent take, and the percentage of total failures was high. At the present time the technique is to keep the wounds clean for the first three days, after which a thick layer of sulfanilamide and a pressure dressing is applied. (The authors believe that sulfanilamide applied too early may slow the separation of sloughs.) After three days of the sulfanilamide dressing the wound is usually ready for grafting. Before the graft is applied the granulations are excised and another layer of sulfanilamide is applied; the graft is then placed directly over this layer, and a pressure dressing is used. Sulfanilamide is given by mouth for thirty-six hours postoperatively. More than 40 cases have now been treated and there has been only 1 failure. All the rest have shown from 75 to 100 per cent take. In view of the experience with other methods these results were believed to be extremely gratifying.

The relative bacteriostatic effects of sulfanilamide, sulfapyridine, and sulfathiazole were demonstrated by *in vitro* experiments. Sulfathiazole was shown to be the most potent bacteriostatic agent on streptococcus, pneumococcus, and staphylococcus. It is 25 times as bacteriostatic as sulfanilamide. Pus fluid inhibits the bacteriostatic effect of all of these drugs.

There is a possibility that a new compound produced by a particular mold penicillium and known as "penicillan" may have distinct future possibilities as a bacteriostatic agent. In its crude form, which contains only 30 per cent of the active principle, it is 4 times as bacteriostatic as sulfathiazole in the test tube and it is not inhibited by large numbers of bacteria as pus fluid.

Finally, some experimental results on wound healing were presented. Antiseptics containing zinc or inorganic halogens generally killed off the fibroblasts more rapidly than they killed the infecting organisms. Sulfanyl flavine and prontosil showed a low toxicity toward fibroblasts and epithelium and increased the rate of granulation and fibrosis.

HOWARD A. LINDBERG, M.D.

**Chemotherapy for Infectious Diseases and Other Infections; Circular Letter No. 81.** *War Medicine*, 1941, 1: 55.

The data on which this circular letter is based have been prepared by the Committee on Chemotherapeutic and Other Agents and the Subcommittee on Infectious Diseases, of the Division of Medical Sciences, National Research Council. This outline is published as a general guide for medical officers and is to be used with due consideration of all other factors which may be presented by each individual case. It is not intended that it be used to the exclusion or neglect of other indicated therapeutic or nursing procedures. The following conditions are discussed:

Hemolytic streptococcic infections

1. Mild or moderately severe hemolytic streptococcic infections, such as erysipelas, mild cellulitis, and tonsillitis. Sulfanilamide is recommended as the drug of choice.
2. Otitis media. If the offending organism is the hemolytic streptococcus, sulfanilamide is recommended. If the infecting organism is a pneumococcus or staphylococcus, sulfathiazole is recommended.
3. Severe hemolytic streptococcic infections, such as meningitis, septicemia, severe cellulitis, acute osteomyelitis, and acute mastoiditis. Sulfanilamide is recommended as the drug of choice.

Scarlet fever

1. Active immunization with toxin, not recommended except for nurses with positive Dick tests and orderlies assigned to care for scarlet fever patients.
2. Simple toxic scarlet fever (exanthematous stage). Antitoxin recommended in moderately severe to extremely severe cases, when patient is not hypersensitive to horse serum. Sulfanilamide should be used for the prophylaxis of septic complications.
3. Toxic and septic scarlet fever. Antitoxin (globulin concentrated) and sulfanilamide recommended.
4. Late septic complications (postexanthematous stage). Antitoxin of no value. Sulfanilamide to be given.

Meningococcic meningitis. Antiserum not generally recommended. It may be used in individual cases. Sulfanilamide is the drug of choice, orally. Lumbar puncture may be done for diagnosis and to relieve pressure.

Purulent meningitis. If the cause is not promptly established, chemotherapy with sulfapyridine should be instituted at once. If oral treatment is impossible, sodium sulfapyridine should be given intravenously (0.06 gm. per kgm. of body weight, made up in 5 per cent solution in sterile, freshly distilled water).

Pneumonia

1. Primary pneumonia
   (a) Pneumococcic pneumonia. Sulfathiazole is recommended as the drug of choice, together with homologous type antipneumococcus serum (preferably rabbit serum).
   (b) Hemolytic streptococcic pneumonia, Friedlander's bacillus pneumonia, and staphylococcic pneumonia. For these cases, sulfathiazole is recommended.
2. Secondary pneumonia. Chemotherapy is of doubtful value in the prophylaxis. When complicating organisms (hemolytic streptococcus, pneumococcus, staphylococcus, or Friedlaender's bacillus) are believed to be etiologically significant, sulfathiazole should be used.

Gas-bacillus infections. In addition to the usual surgical procedures, polyvalent tetanus and gas-bacillus antitoxin, and sulfanilamide should be used for prophylaxis and active treatment.

Staphylococcic infections. For large carbuncles, boils, diffuse cellulitis, lymphangitis and acute osteomyelitis, sulfathiazole is advised, in addition to accepted surgical procedures. For staphylococcic bacteriemia, sulfathiazole should be used, in addition to drainage of the suppurating foci. When possible, laboratory control of bacterial chemotherapy should be carried out. Examinations for hemoglobin, total and differential white counts, and a study of the urine for blood should be carried out. Headache and malaise are early toxic symptoms.

"If fever recurs after the patient's temperature has been normal in the course of treatment with sulfanilamide or one of its derivatives, the drug should be discontinued immediately or if recently discontinued should not be resumed unless it has been demonstrated that the fever is due to a recurrence of the infection. Whenever therapy with the sulfanilamide drugs is stopped because of a drug reaction, fluids should be forced so that 5,000 cc. per day is taken in order to wash out the drug.

"Any patient who has had a toxic reaction to one of the sulfanilamide group of drugs may have a second, and more severe, reaction if one of these drugs is prescribed again. To such patients a small test dose of the drug (0.1 to 0.3 Gm.) should be given and the patient observed for twelve hours before intensive therapy is started, following which the patient must be carefully observed and the drug immediately stopped on the first appearance of any toxic manifestation." J. M. MORA, M.D.

**Amies, C. R.: The Stability of Tetanus Antitoxin Under Suboptimal Storage Conditions.** *Brit. M. J.*, 1941, 1: 709.

Under war conditions, it is not always possible to store sera under optimal conditions, hence it is a matter of importance to know the rate at which

antisera deteriorate under suboptimal storage circumstances.

As a control the author studied the rate of deterioration of unconcentrated tetanus antitoxin in which 0.35 per cent cresol was used as a preservative. Assays were carried out on guinea pigs at the L ±5 level, the same test toxin being used throughout. Samples were kept at from 2° to 4° C, at room temperature, and at 37° C for a year. At the end of this time it was found that there was little or no deterioration in the potency of the sera kept near the freezing point. Serum kept at room temperature lost less than 10 per cent of its potency, while serum kept at 37° C lost between 40 and 50 per cent of its strength.

As a practical check, sera were collected from A.R.P. medical storage centers at the end of two years and checked for potency. In these samples the loss in potency ranged from 8 to 27 per cent, and depended on the storage conditions.

It was found further that the freezing of sera had no deteriorating effect on antisera, provided that breakage of the container or forcing of the rubber caps had not occurred.

As a general rule, anti-tetanic sera lose about 10 per cent of their potency per year under average room temperatures. LUTHER H. WOLFF, M.D.

**Nicoll, E. A.: Rehabilitation of the Injured.** *Brit. M. J.*, 1941, 1: 501.

The principles for the successful rehabilitation of the injured are described by the author who has had extensive experience in a special central clinic receiving yearly more than 6,000 incapacitated workers. Soft-tissue and muscle function should be conserved even during the period of immobilization.

In the later stages of rehabilitation, disabilities such as contracture, atrophy, and fibrosis can be overcome by passive movements and graduated resistance exercises for strengthening selected muscle groups. The pulley-and-weight apparatus is generally applicable for any group of muscles in the body and also can serve as an instrument for measuring muscle efficiency.

Accessory rehabilitation methods consist of occupational therapy, physiotherapy, and remedial games. These include indoor and outdoor forms of progressive activity and are specifically selected for the individual and his injury. Physiotherapy in the form of faradism and deep massage is beneficial in the treatment of localized fibrosis and exudates. Deep massage is more effective when the aponeurosis of the painful muscle is injected first with procaine.

Of a series of 1,200 patients treated with these principles in mind, 87 per cent returned to their work, and 9 per cent took up light work in the same occupation. BENJAMIN G. P. SHAFIROFF, M.D.

**DeLorimier, A. A.: Wartime Military Roentgenology.** *Radiology*, 1941, 36: 391.

After briefly considering how wartime military roentgenology differs from that of civil practice in peace time, the author discusses the planning required for present-day field activities in two phases: roentgen requirements near home communities, and roentgen requirements in the theater of operations. In connection with the first phase, the need and advantages of chest roentgenography and the methods best adapted for it are given detailed consideration.

In order to show how personnel and equipment of the x-ray service for military uses fit into the general scheme the disposition of various units is briefly described and illustrated. The most advanced installation in which x-ray services will be available is the mobile surgical hospital. Most of the x-ray activities here will be fluoroscopic, including the localization of foreign bodies. Facilities for superficial x-ray therapy are also provided. The equipment and methods deemed most advantageous are described at some length.

In the evacuation hospital it is expected that the same types of equipment will be used as are used for the mobile surgical unit. Most of the work will be fluoroscopic, although it is estimated that perhaps 10 per cent of the activities may be roentgenographic. The additional facilities required for the latter are given consideration. The general hospitals are usually of permanent or semi-permanent construction and the installations in them will be comparable to those of large institutions in civil practice to meet the varied radiological requirements. Station hospitals, provided the professional activities warrant, will be equipped similarly to the evacuation hospitals.

In his summary the author states, "For the theater of operations the designing of equipment has been governed by at least three axiomatic principles: (1) versatility of adaptation to the extent that each piece of equipment will function not merely for a single purpose, but for several requirements and installations; (2) portability to the extent that disassemblage of each item can be easily accomplished and that the component parts can be easily carried, the weight of any one part not exceeding two hundred (200) pounds, and (3) practicality of design to the extent that the equipment can serve the requirements of function in peace-time installations as well as in zones of combat.

"Applying these principles, the combination x-ray table unit, x-ray machine unit, and mobile x-ray chassis were designed to provide for a nine-way adaptation: (1) horizontal fluoroscopy; (2) foreign body localization by means of a rapid fluoroscopic method; (3) sitting fluoroscopy, the design of the x-ray tube and screen supports providing for easy and quick shifting for the study of a patient supported to a sitting position on the litter; (4) standing fluoroscopy, to the extent of accommodating routine chest studies and also gastro-intestinal studies; (5) horizontal roentgenography, with conventional focal-film distances from 25 to 40 inches; (6) six-foot vertical chest studies; (7) six-foot horizontal chest studies, the patient lying on a litter, upon the floor; (8) ordinary bedside work in the wards, by means of

mounting the component parts of the x-ray machine upon a mobile chassis; (9) superficial roentgen therapy, to the extent of milliamperage capacities of 4 and kilovoltage potentials up to 100."

ADOLPH HARTUNG, M.D.

## OPERATIVE SURGERY AND TECHNIQUE; POSTOPERATIVE TREATMENT

**Debenham, M.: The Primary Repair of Tendons.** *California & West. Med.*, 1941, 54: 273.

The author reports a survey on the primary suture of tendons, and states that there has been very little written of an exact character regarding the time for primary suture. Certain authors recommend that if the patient is seen within four hours of the time of injury primary suture should be done, but it should not be attempted after twelve hours. The principal objection of those advising against primary suture is that it increases the incidence of infection. The author quotes Boehler, who states that if statistics were available as to primary suture, the incidence of infection would be high. Koch and Mason report that 80 per cent of their cases healed per primam, 10 per cent were infected, and the other 10 per cent had a gross infection following division of the tendons and nerves. The author agrees with several other authors that the most unsatisfactory results are caused by postoperative adhesions in which the tendon, the sheath, and the surrounding soft tissues all enter into the formation of the scar. He believes it is inevitable that adhesions will occur, and that non-union is least often the cause of a poor result. The placing of the suture in the tendon is very important and all surgeons agree that it should extend well away from the cut ends on each side. The author thinks that the "atraumatic technique" suggested by Bunnell would go far toward insuring union.

The local infiltration of novocaine is very widely used, but in those cases in which the operative procedure will last for hours, a general anesthetic is preferred.

A tourniquet makes the operation technically much simpler and the use of a pneumatic cuff around the upper arm inflated to 300 mgm. of mercury and another placed around the forearm is recommended. These will compress the muscle bellies of the involved tendons and force the retracted tendon ends into the wound. Hydrogen peroxide may be flushed into the wound and is of some value. The depths of the wound should be lavaged copiously with a gentle stream of normal saline solution and careful débridement should precede any attempt to search for the tendon ends. The author strongly cautions against introducing a clamp blindly into the tendon sheath in search of the tendon, as this will usually produce sufficient trauma to be a major factor in the formation of postoperative adhesions. The method he recommends is to locate the tendon end through a small transverse incision into the sheath proximal to the wound. The exact location for this second incision can be made by passing a fine silver wire probe up into the tendon sheath, to which the tendon can be attached and then retracted into the wound.

The postoperative care of these sutured tendons varies somewhat and is really a balance between two factors—the strength of the suture line and the formation of adhesions. Probably early active motion within the first few days can be safely accomplished within the limits of pain, but it is unwise to attempt passive motion before the fifteenth day. In Debenham's series the number of poor results increased in direct proportion to the length of time the tendons were immobilized.

PAUL C. COLONNA, M.D.

**Cotta dos Santos, H.: Some Remarks in Favor of Ricard's Operation. Surgical Conduct in Crushing of the Foot** (Algumas palavras em favor da operação de Ricard. Conduta cirúrgica nos esmagamentos do pé). *Rev. méd. municipal*, 1941, 1: 226.

The ideal in amputations is to obtain a painless, esthetic stump that can be used without the aid of any apparatus. Unfortunately, this is rarely possible; therefore, Cotta dos Santos reports a case in which he had the opportunity to verify the superiority of Ricard's operation to obtain this ideal result.

A boy, aged twelve years, trying to board a moving train, fell and a wheel passed over his left foot about the level of the middle tarsal articulation. He was operated upon soon after the accident: the crushed portion of the foot was cut off in the line of the lesion, the wound was washed with ether, hemorrhage was arrested, a double piece of gauze was placed over the wound, and three horsehair sutures were introduced to approximate the dorsal and plantar parts of the skin over the gauze without tension. Healing proceeded without incident, but the beginning of equinism, the frequent complication of stumps after Chopart's amputation, could already be observed after eight days, and it became more marked during the following weeks. The equinism was evidently caused by the retraction of the muscles of the calf of the leg in the absence of opposing action by anterior muscles. Two months after the accident when the wound was nearly completely healed, Ricard's operation was performed as follows:

An incision starting 1 cm. in front of the external malleolus, running anteriorly over the stump through the granulating surface and ending posteriorly 1 cm. below the internal malleolus was made; the astragalus was carefully excised so as to respect the connections of the calcaneus with the tibia and fibula. The calcaneus was introduced into the tibiofibular mortise so that the internal malleolus fitted behind the small apophysis of the calcaneus, and the large apophysis of the calcaneus which protruded in this position of the bone was excised. The skin was sutured, and a horsehair drain was passed through the new joint. The equinism had disappeared and healing was uneventful; forty-five days after the

intervention, the patient could walk normally on the stump, which was painless and gave solid support on its plantar aspect. The new joint presented a slight passive lateral mobility and the left leg was nearly 2 cm. shorter than the right. One month later, the patient was seen again; he walked perfectly using an ordinary shoe.

The aseptic evolution of the first intervention seems to suggest that an equally good result would have been obtained if the final operation had been performed at that time. Nevertheless, the author believes in the two-stage intervention in crushing injuries of a limb: an urgent one to save life and prevent infection, and a purely orthopedic one a few weeks later. The two interventions complement one another and have each a distinct object. The first must be simple and rapid, preferably under general anesthesia and with the use of the Esmarch bandage or a simple rubber tube to insure against loss of blood; it must be as economical as possible and therefore ignore the classical points for amputation. Any idea that the intervention may be less economical in the lower than in the upper extremity must be discarded. The decision as to what to save and what to sacrifice may be very difficult in cases in which there has been no real crushing, but in which there are multiple lesions with considerable attrition of the soft tissues and comminuted fracture. The second intervention is much more delicate than seems to be indicated by the usual term of "retouching" the stump. It is advisable that this second stage be planned in collaboration with the prosthetist who will make the apparatus for the limb, as this can only result in benefit for the patient.

In transverse crushing of the foot, the author recommends Ricard's astragalectomy as the ideal intervention because it corrects or avoids equinism, it causes only slight shortening of the leg, it allows direct walking on the stump without apparatus, it avoids the necessity of sectioning the Achilles tendon, it provides the possibility of anteroposterior movements in the tibiocalcaneal joint, thereby insuring better walking, and, finally, in case of failure, it still leaves the stump open to other interventions.

RICHARD KEMEL, M.D.

**Maes, U., and Davis, H. A.: Fluid Replacement in Surgical States, with Particular Reference to Transfusion of the Ascitic Fluid; A Clinical and Experimental Study.** *Arch. Surg.*, 1941, 42: 453.

The purpose of the authors in this article is to present (1) a study of the abnormal physiological picture which results from loss of water, electrolytes, and blood; (2) the technique of fluid replacement; (3) a critical evaluation of blood replacement fluids; and (4) the present status of transfusion of the ascitic fluid.

The indications for fluid replacement fall into four main groups, viz., loss of (1) body water, (2) electrolytes, (3) whole blood, and (4) plasma. The causes of dehydration may be divided into two groups: exogenous and endogenous. Among the more important exogenous causes are voluntary or enforced deprivation of water, excessive sweating due to sunstroke, heat prostration, traumatic shock, and surgical operations. Endogenous causes are prolonged diarrhea due to surgical lesions of the intestinal tract, vomiting due to obstructing lesions of the gastro-intestinal tract, and the inability to swallow liquids, due to obstructing lesions of the esophagus.

The dehydration causes the skin to become wrinkled and dry, and the mucous membranes lusterless. The eyeballs become soft. As a result of the deficient flow of blood, the extremities are cold. The respirations may be deep and of the "air hunger" type, due to acidosis.

Tests which may be applied to the skin and to the blood are the following: (1) standard wheal formation; (2) intradermal salt absorption; (3) intradermal serum absorption; (4) erythrocyte concentration; (5) hemoglobin concentration; (6) hematocrit readings; and (7) determination of the specific gravity of the blood plasma. The response to the administration of water may be determined by (a) the excretion of urine; (b) the time curve of blood dilution; and (c) the rate of oxygen consumption.

The authors' discussion refers only to dehydration uncomplicated by gross losses of electrolytes or of blood. Minor grades of dehydration may be treated by water administered by the oral or the rectal route. However, many dehydrated patients require treatment with fluids given intravenously.

Surgical causes of the loss of electrolytes are vomiting, diarrhea, discharges from suppurating wounds, prolonged use of Wangensteen or Miller-Abbott gastro-intestinal tubes, the production of artificial openings in the intestinal tract, and prolonged drainage from a biliary fistula.

The degree of electrolyte loss may be estimated by: (1) determination of the level of plasma sodium chloride, which varies normally from 560 to 630 mgm. per 100 cubic centimeters of blood; (2) determination of the carbon-dioxide-combining power of the plasma; and (3) determination of the degree of secondary dehydration by means of blood studies, erythrocyte count, and hemoglobin evaluation.

The authors have found that an isotonic solution of 5 per cent dextrose with 0.9 per cent sodium chloride provides an excellent replacement fluid.

The immediate effects of hemorrhage are an increase in the heart and respiratory rates, contraction of the spleen, and generalized vasoconstriction. Various fluids have been advocated for replacement of blood, fresh whole blood being the most efficacious fluid. Others discussed are crystalloid solutions, acacia solution, preserved blood, hemoglobin in solution, blood plasma and serum, and human ascitic fluid.

Loss of either the protein or the aqueous fraction may occur and may be acute or chronic. The effects are dependent on the rate of the loss, and the nature of the fraction lost. Direct determination of the plasma volume may be carried out by the various

dye methods. Indirect determinations will reveal hemoconcentration with a normal or slightly lower concentration of plasma protein when acute loss has occurred. The authors note that only protein-containing fluids, such as whole blood, plasma, serum, and ascitic fluid, are indicated. In treating hypoproteinemia with transfusions of ascitic fluid, it is not necessary to limit the amount of fluid transfused to 500 c.cm. As much as 2,500 c.cm. may be used within twenty-four hours. Lyophile plasma, acacia solutions, hypertonic and isotonic solutions of sodium chloride, and desoxycorticosterone acetate are all contraindicated.

HERBERT F. THURSTON, M.D.

**Taylor, N. B., and Waters, E. T.: Isinglass as a Transfusion Fluid in Hemorrhage.** *Canadian M. Ass. J.*, 1941, 44: 547.

The prime requisite in the treatment of shock or in hemorrhage is to fill the blood vessels and thus maintain the blood pressure. Whole blood is, of course, the ideal transfusion fluid but plasma and serum are very satisfactory substitutes. When one considers, however, that in shock or in hemorrhage as much as 2 liters of appropriate fluid may be necessary and must be quickly available, the need for a blood or plasma substitute is evident. A transfusion substitute for blood or plasma must answer the following requirements:

1. The molecule of the dissolved substance must be of such a size that the fluid will not leave the vessels too freely.

2. The solution must exert an osmotic pressure and possess a viscosity approaching as closely as possible that of whole blood; these qualifications depend upon molecular size and shape.

3. It should be as nearly as possible isotonic with the contents of the erythrocytes.

4. It must, of course, be non-antigenic and innocuous in every respect. In addition, it should be readily available, preferably cheap, and capable of being quickly and easily prepared for intravenous administration. Provided it is suitable in the respects just listed, there appears to be valid objection to the use of some fluid other than blood or serum to fill the vessels after hemorrhage.

A solution of ordinary animal gelatin meets all of the requirements except the last. Because of its source it may be infected with anthrax or tetanus bacteria in spite of adequate precautionary measures of preparation. Fish gelatin or isinglass as prepared from the swim bladders of the sturgeon or sea trout obviates all danger of anthrax or tetanus infection. The crude material is relatively cheap, is used in the brewing industry, and when prepared according to the author's method is non-toxic in dogs.

It is stored in a dry state and made up for use immediately before transfusion by the addition of normal saline solution and 2.5 per cent sodium bicarbonate; a 7 per cent solution is used. The fate of isinglass after its introduction into the body is not fully known; however, unlike acacia, it is not taken up by the liver, but is probably broken down and metabolized by body tissues.

The molecular weight of gelatin varies from 10,000 to 96,000 and a 7 per cent solution has an osmotic pressure of 38 mm. of Hg. This is considerably higher than that of plasma with a pressure of from 25 to 30 mm. of Hg. The viscosity of this solution is about three times that of plasma, but only one-half that of whole blood. A 7 per cent solution does not gel at room temperature.

Fifteen dogs under ether anesthesia were bled from the femoral artery during one-half hour periods, and from 35 to 63 per cent of the calculated blood volume was lost. The average drop in the blood pressure varied from 80 to 100 mm. of Hg. From 50 to 70 per cent of the quantity of the blood lost was replaced by a 7 per cent solution of isinglass, given slowly. Eleven of these dogs recovered completely; the 4 others recovered from the anesthetic and lived from three to twenty-one hours. Of 15 controls dogs which were bled the same way, but more slowly, 11 died in periods ranging from one to ninety minutes; 1 lived seven hours, and 3 recovered completely.

In general, isinglass is non-antigenic, but mild antiphylaxis could be produced within fourteen-day intervals following a large transfusion. There was no evidence of sensitization after a three-week period. This sensitivity was believed to be due to fish-protein contamination and not to the gelatin itself. Such contamination could probably be removed by more vigorous purification.

The authors believe that 7 per cent solutions of fish-gelatin transfusions were definitely life-saving in dogs that had lost as much as 52 per cent of their circulating blood volume. Without these transfusions the animals would have died. No comment was offered as to the advisability of human trial.

HOWARD A. LINDBERG, M.D.

**Rowlands, R. A., and Wakeley, C. P. G.: Fat Embolism; 2 Fatal Cases; A Case with Recovery; Etiology; Mechanism; Post-Mortem Appearance; Symptoms and Physical Signs; Differential Diagnosis; Treatment.** *Lancet*, 1941, 240: 502.

The authors state that war wounds often cause simple or compound fractures of the bones and widespread laceration of the subcutaneous and other fat-laden tissues; hence, fat embolism would be a likely complication. Three cases are reported, 2 confirmed by autopsies, and a third, in which the clinical course justified the diagnosis and the patient recovered.

The incidence of fat embolism is 8 times more frequent in men than in women, and most common during the third or fourth decades of life. It rarely occurs in children under the age of fourteen.

The causative factors of fat embolism are summarized as traumatic and non-traumatic. The traumatic group includes injury to the osseous system by fractures; jarring of the skeleton, or orthopedic operations; and trauma to subcutaneous and intermuscular fat and fatty viscera, including injury

by burns. Classified as dubious are such non-traumatic factors as certain poisons, diabetes, the injection of oily substances, eclampsia, and childbirth. The greatest number of the traumatic cases follow fractures of the long bones, and especially of the lower limbs. The degree of comminution bears no relation to its incidence.

Three conditions are considered necessary for the absorption of the fat into the circulation at the site of the injury: rupture of the connective-tissue cells liberating the fat; rupture of neighboring blood-vessels providing a portal of entry; and some other factor causing the free fat to pass into the circulation. The first two of these conditions are present in fracture of the long bones.

Fritsche found that ligation of the veins of an injured limb did not prevent the occurrence of pulmonary fat embolism. Most authorities, however, believe that lymphatic absorption does not play any real part in the causation of fat embolism.

The capillary bed of the lungs is the first obstructive area to fat after absorption into the blood stream. The lungs are capable of accommodating large numbers of fat emboli, and only in severe cases does embolism obstruct pulmonary circulation.

The authors discuss three main clinical types, viz.: pulmonary fat embolism, systemic fat embolism, and a cardiac type. Two varieties of pulmonary fat embolism are recognized. In one of these, a few hours after trauma, large amounts of fat are absorbed rapidly, flood the pulmonary circulation, and the patient dies suddenly with clinical signs of acute edema of the lungs. The other type develops more slowly, usually three or four days after the accident.

The physical signs are as follows: the cerebrospinal fluid in uncomplicated cases shows no abnormality except slightly increased pressure. The patients are usually pyrexial; the temperature is usually about 103° F. but may vary from subnormal to 107° F. Tachycardia is always present and increases with the pulmonary congestion and cerebral involvement. The skin and mucous membranes often show petechial hemorrhages at the time of the stupor. Quantitative estimations of fat in the blood are beyond the ability of the average part-time chemist to carry out accurately. The kidneys are involved in most cases of fat embolism.

The diagnosis is made on the history of injury and the onset of typical clinical manifestations usually within the first three days after the injury. As a rule, there is increasing pyrexia, tachycardia, and dyspnea, with crepitations over the lungs and petechiæ over the upper part of the chest, followed by restlessness, insomnia, delirium, stupor, and coma, with no focal neurological signs. There will be roentgenological changes in the lungs, a rapid decrease in the percentage of hemoglobin, and possibly fat globules in the urine.

Suggestions advanced for the treatment of fat embolism are mainly palliative or empirical. The following prophylactic measures are mentioned:

Unnecessary or rough handling of patients should be avoided: all fractures should be reduced early and splinted immediately: manipulations should be as few as possible: if the condition of the patient permits he should be propped up in bed.

Saponifying or emulsifying the fat by the intravenous infusion of a 2 per cent solution of sodium bicarbonate with administrations of large quantities of intravenous saline solution to wash the emboli through the capillaries have been suggested. Subsequent experience does not support either of these therapeutic measures. The administration of cholalic and desoxycholalic acid even in the smallest doses caused hemolysis. The administration of sodium desoxycholate intravenously in doses of 10 c. cm. of 20 per cent solution, given very slowly in a drip infusion every two hours has been advocated. The latter treatment is in the experimental stage. The administration of oxygen is helpful.

In concluding, the authors state that in fat embolism many more observations are needed on the morphological, physical, and chemical condition of the blood and cerebrospinal fluid; electrocardiographic and pulmonary roentgenological changes demand careful study. Further observations should be made on the effect of high concentrations of oxygen, and on methods which will increase the emulsifying power of the blood and hence diminish the size and obstructive power of the fat globules in the capillaries. HERBERT F. THURSTON, M.D.

## ANTISEPTIC SURGERY; TREATMENT OF WOUNDS AND INFECTIONS

**Key, J. A.: The Early Operative Treatment of Acute Hematogenous Osteomyelitis.** *Surgery*, 1941, 9: 657.

In a concise article the author gives his reasons for advocating early and adequate drainage of acute hematogenous osteomyelitis, and outlines his method of treatment. The staphylococcus is the organism involved in 90 per cent of the patients over two years of age. The human being is not able to develop much general immunity to this organism, which has a tendency to invade the blood stream and produce septicemia and metastatic abscesses, according to the number of organisms involved.

The primary focus usually is unimportant. The organism enters the bone from the blood stream. The initial dose of the organism must have been small, or septicemia or multiple primary abscesses would have occurred. Since the interior of the bone contains no sensory nerves, local symptoms do not occur until the inflammation has reached the periosteum. General symptoms arise from the absorption of toxic products. The general and local symptoms usually occur at the same time: therefore a considerable amount of tissue must be involved and it is probable that the disease has been present from two to five days or longer before clinical symptoms appear. Because of the difference in architecture, local inflammation in the rigid, non-expansile bone

results in more rapid and extensive necrosis than in soft tissues. The author attributes the frequency of septicemia and the excessive toxemia to the increased pressure generated within the shaft which forces the organism into the blood stream. Because the usual walling-off is hindered, he believes the toxemia will persist until drainage is instituted.

Treatment begins with full doses of sulfathiazole given by mouth or sodium sulfathiazole given intravenously. Usually from eight to twelve hours are sufficient to correct exhaustion and dehydration. The extremity should be immobilized during this period. If the patient is extremely toxic, large doses of staphylococcus antitoxin should be given. Gentle handling of the patient before and during operation is essential. Incision should be made by the most direct route, be ample but not excessive, and be made with the least jarring possible. Regardless of whether pus is encountered after incision of the periosteum, the medulla of the bone should be opened. The author uses a sharp osteotome or drills a number of holes and connects them with a sharp osteotome, according to the thickness of the cortex. No attempt is made to remove necrotic bone. The wound is sprinkled generously with powdered sulfathiazole and packed with vaseline gauze, and the limb is immobilized by cast, splinting, or traction. Postoperative blood transfusions and antitoxin are given if indicated.

He believes this treatment will decrease mortality, prevent chronic osteomyelitis, and lessen joint injury, secondary foci, and the amount of bone destruction at the primary focus.

In patients under two years the treatment is the same except that operation is usually delayed until an extra-osseous abscess develops. Because the infant bone has large canals and relatively little organic matter, infection acts much as an infection in soft tissue. An extra-osseous abscess forms early and may be opened and drained without disturbing the bone. Because the infant bone is porous, that portion killed tends to be absorbed without sequestration. About 50 per cent of the cases in infants are caused by streptococci, and these infections tend to heal without sequestra. MARIAN BARNES, M.D.

**Wilson, J. C.: The Delayed Operative Treatment of Acute Hematogenous Osteomyelitis.** *Surgery*, 1941, 9: 666.

The author summarizes a study of 33 cases of acute hematogenous osteomyelitis occurring in children admitted to the orthopedic wards of Children's Hospital, Los Angeles, since 1935. The ages ranged from seventeen months to twelve years. Thirteen children were female, 20 male. There was a history of previous furuncles in 4 cases; urinary infection in 9; superficial infection such as blisters, scratches, and splinters in 5; impetigo in 2; otitis media in 1; chicken pox in 1; and laryngitis in 1. The remaining 10 cases gave no history of a previous lesion which might have been construed as the primary source of infection.

The staphylococcus aureus was the causative organism in 27 cases, the streptococcus in 5 cases, and the staphylococcus citreus in 1 case. The staphylococcus aureus was recovered from the blood stream of 17 patients, and the streptococcus from 2. In 30 the primary bone lesion was in the lower extremities; in 3, in the upper extremities.

The author divides the patients into four groups. Group 1 consisted of 8 patients whose lesions were drained in the first seven days of their illness. There was 1 metastatic lesion and 1 death in this group. In Group 2 there were 18 patients whose lesions were drained the seventh to fourteenth day. There was 1 metastatic lesion and there were no deaths in this group. In Group 3 there were 3 patients whose lesions were drained the fourteenth to twenty-first day. There was one metastatic lesion and no death. Group 4 consisted of 4 patients who received no drainage. Three drained spontaneously. The fourth was moribund on admission and died the following day of bronchopneumonia.

The author believes that the patient with acute hematogenous osteomyelitis is "a patient with septicemia who develops an abscess within the substance of the bone," and that drainage should not be done until the location of the focus can be determined with some degree of accuracy, and there is reasonable evidence that pus is present.

He believes that drug therapy is invaluable in letting the surgeon choose the optimum time for operation. Chemotherapy should not be used until the type of invading organism is determined; then sulfanilamide is used in streptococcal infections and sulfathiazole in staphylococcal. He warns against a false sense of security when the toxic symptoms subside under drug therapy. Roentgenograms of progressive bone changes in three children whose toxic symptoms subsided under chemotherapy and transfusions are reproduced in the original article.

In 17 of the patients the bone lesion healed. Eight cases still show drainage from the wound but some of these are recent cases and healing is expected in at least half of them within six months. Five patients have disappeared and the results are unknown.

MARIAN BARNES, M.D.

**Hooker, D. H., and Lam, C. R.: Absorption of Sulfanilamide from Burned Surfaces.** *Surgery*, 1941, 9: 534.

The authors relate their experiences in applying sulfanilamide on freshly burned areas. They sprinkled the dry powder on small areas in 8 cases. The rapidity of absorption and the high blood levels obtained were striking. Their experiments give evidence pertaining to the debated question of whether or not there is considerable absorption of diffusible material from burned skin.

Five grams of powder were applied initially and small amounts added later, which made a total of about 40 gm. over a period of three and one-half days. The curve of the blood sulfanilamide reached a level of 9.4 mgm. but no infection developed.

The authors do not advise the widespread use of sulfanilamide in the treatment of burns. There is too much danger of overdose. It would appear to be useful, in case of a large infected burn, to put the powder on a small portion and to obtain the desired blood level by this route rather than by mouth.

The authors' experience is additional evidence pointing against the view that burned tissues form a poor absorbing surface.

HOWARD A. MCKNIGHT, M.D.

## ANESTHESIA

**Perelman, I. M., and Bernstein, V. S.: The Use of Sovcaine for Local and Spinal Anesthesia.** *Nov. khir. arkh.*, 1941, 48: 179.

The drawbacks of the popular local anesthetics, viz., short duration of action and secondary pains, have been overcome by synthesis of new products such as pantocaine and nupercaine.

The new anesthetic, sovcaine, synthetized in Soviet Russia, is less toxic than nupercaine and produces an anesthesia of from six to eight hours' duration. It can be used for local as well as spinal anesthesia and causes no secondary pains following the operation.

The authors use a 0.5 per mil solution in distilled water, without adrenaline, for local anesthesia, and from 0.3 to 0.6 c.cm. of a 1 per cent solution for spinal anesthesia. Neither the local nor the spinal anesthesia causes a fall of the blood pressure, and not infrequently the latter rises from 20 to 40 points after the use of the new anesthetic.

However, to play perfectly safe, the authors recommend a subcutaneous injection of 1 c.cm. of a 5 per cent ephedrine solution one-half hour before the spinal anesthesia. A pre-operative injection of morphine is advisable.

The new anesthetic is suitable not only for operative procedures but also for the reduction of fractures and dislocations. JOSEPH K. NARAT, M.D.

**Lemmon, W. T., and Paschal, G. W., Jr.: Continuous Spinal Anesthesia.** *Pennsylvania M. J.*, 1941, 44: 975.

Lemmon and Paschal report their observations on continuous spinal anesthesia, in their first 500 cases.

By this method anesthesia is maintained as long as desired by adding subsequent small doses as they are needed—a fractional dose method.

In every instance anesthesia was produced to the desired level and degree, and in each case the operation was completed under spinal anesthesia. Supplementary anesthetics were not needed. There were no anesthetic deaths and no neurological complications. Toxic symptoms were promptly controlled by withdrawal of the drug (novocaine), by rapid aspiration of spinal fluid, and by giving oxygen inhalations.

For pre-operative medication, nembutal (3 gr.) is given the preceding evening and three hours before operation. Morphine sulfate (¼ gr.) and scopolamine hydrobromide (1/100 gr.) are given an hour before operation. If added sedation is desired, additional small doses of morphine are given during the operation.

The average age of the patients for the series reported was thirty-nine years, the average length of operation fifty-three minutes, and the average total dose of novocaine 242 mgm. Blood-pressure fluctuations were much less marked than in other methods of spinal anesthesia, the average fall in systolic pressure being only 14 points. Headache occurred in 2.5 per cent of the cases, urinary retention in 3.1 per cent, and lung complications in 3.8 per cent.

The technique is described in detail.

J. M. MORA, M.D.

# PHYSICOCHEMICAL METHODS IN SURGERY

## ROENTGENOLOGY

**Nowell, S.: Increasing Density of the Renal Shadow During Excretion Urography; A Sign of Acute Ureteric Obstruction.** *Brit. J. Radiol.*, 1941, 14: 138.

During the past few months, the author observed 3 cases in which excretion urography resulted in a progressive increase in the density of one kidney shadow during the course of the examination. These 3 cases are briefly presented and their roentgenograms reproduced. They all had a demonstrable stone in the ureter of the corresponding side. Two of the cases were re-examined by excretion urography: one, about four weeks after the stone had passed, when it had a normal roentgenographic appearance; and the other, five weeks after the first examination, which then showed hydronephrosis and hydro-ureter down to the calculus, which had now descended to the level of the lower ureteral orifice.

After a brief review of the literature, the author tries to harmonize his own observations with those of other investigators, such as Wesson and Fulmer, Wilcox, Dourmaschkin, and Narath, and arrives at the following conclusions:

1. An acute obstruction of one ureter may cause a progressive increase in density of the corresponding kidney shadow, during excretion urography.
2. This increased density is due to the contrast medium being concentrated and remaining in the uriniferous tubules as a result of the pressure of the dammed-up contents of the renal pelvis.
3. On the cessation of the acute phase the pelvis and calyces will be demonstrated by the dye during excretion urography.
4. After one or more of such acute phases a hydronephrosis may occur, and conversely, an acute phase may occur in a case with a previously hydronephrotic kidney.

It is the author's view that the increasing density of a kidney shadow during excretory urography may be diagnosed as ureteric obstruction and, with certain reservations, as a differential sign from acute right-sided abdominal lesions. T. LEUCUTIA, M.D.

**Masserini, A.: Roentgen Aspects of Giant-Cell Tumors of the Bones Treated with Roentgen Irradiation** (Aspetti radiografici dei tumori giganto-cellulari delle ossa trattati con roentgenterapia). *Radiol. med.*, 1941, 28: 84.

Although the literature of the past twenty years contains many works on giant-cell tumor of the bones, it offers relatively few roentgenological data on the changes which occur during roentgen treatment and on the final aspect of the bone when clinical cure of the pathological process can be accepted. And yet, roentgen observation is important because it reveals whether the tumor responds to irradiation or not, and, in the latter case, allows timely use of surgical intervention to eliminate the possible danger of malignant degeneration. Masserini describes the roentgen aspect of 5 irradiated cases which he has had under observation for several years.

Investigation of the behavior of giant-cell tumors shows that as long as the process remains active it tends to destroy the bone, which it replaces by the characteristic giant-cell tissue, and to increase the size of the bone; when the process is arrested spontaneously or by roentgen treatment, the changes stop but do not regress. Therefore, it is never possible to determine clinically when the disorder is arrested or cured, especially as the subjective condition of the patient does not offer any help. Rupture of the cortex and tumoral invasion of the soft tissues, which constitute favorable conditions for clinical control of arrest or improvement of the process, occur rarely; on the other hand, the problem may be complicated by a sudden exacerbation or by malignant transformation of the tumor. In opposition to these difficulties, which inevitably confront the physician, stand the relative facility and reliability of the roentgen investigation.

The study of the present cases shows that rather typical and nearly always demonstrable roentgen pictures correspond to the evolution of the tumor toward improvement or cure. Careful comparison of the films taken during and after irradiation reveals in the trabeculæ and in the cortex certain changes which gradually become more distinct. There is a process of recalcification consisting of an increase in the thickness and opacity of the remaining cortex and of the internal trabeculæ, and, at times, a filling of the transparent spaces of the tumor by bone tissue rich in calcium salts. The final result may be the roentgen aspect of solid bone and even of complete and intense eburnation. The form assumed by the bone during the disease is in general not changed by healing: if the process has ruptured the cortex and invaded the soft tissues, calcification takes place in the latter. These changes occur with extreme slowness: control films taken after two and three years, and even later, show new signs of further improvement in the recalcification. On the other hand, at the end of the radiation treatment it is impossible to find with certainty any favorable change in the roentgen picture of the tumor; instead, as happened in one of the present cases, a temporary aggravation may be observed: this is known as the paradoxical phenomenon of Herendeen and consists of further decalcification of the cortex and neoplastic structural framework, and of a tendency of the tumor to spread to the neighboring tissues, associated with a return of the subjective clinical symptoms. However, the absence of immediate signs of improvement or the presence of Herendeen's reaction is no reason to

doubt the efficacy of the roentgen treatment. It imposes vigilant observation, and requires that the possibility of a new series of irradiations be kept in mind. RICHARD KEMEL, M.D.

**Hansson, C. J.: Arthrographic Studies on the Ankle Joint.** *Acta radiol.*, 1941, 22: 281.

Arthrographic studies were made of 48 ankle joints. After the usual lateral and frontal roentgenographs had been made and after anesthesia had been produced by novocain, 3 c.cm. of 35 per cent perabrodil were injected in the frontal area of the joint, immediately on the inner side of the medial malleolus. If the joint was much distended by intra-articular hemorrhage, as much blood as possible was withdrawn and 6 c.cm. of perabrodil were injected. The arthrograms were made immediately after a few movements of the joint. Frontal and lateral roentgenographs were made with the foot in positions of extreme abduction and adduction. No discomfort was noted by the patients other than a slight burning pain in the soft structures in cases in which leakage from the capsule or syndesmosis had occurred: this disappeared in about an hour.

The various types of injuries which were observed are catalogued, and their frequency noted. In 3 instances there had been old injuries, and ligamental insufficiency was found on the lateral aspect of the ankle joint, with leakage to the tendon sheaths of the peroneus muscles. In 4 cases, the arthrogram was normal with the exception that there was leakage from a tendon sheath to the sheath of the posterior tibial muscle. Two of these represented old, and 2 were recent injuries. Rupture in the capsule and ligaments on the lateral side of the joint, with leakage of the contrast medium into the soft structures was found in 7 cases; these were all recent injuries. Ligamental insufficiency or rupture on the medial side, found in 4 cases, was associated with rupture of the syndesmosis in 2 instances. Two cases were old, and 2 were recent injuries. A connection between the talocrural joint and the posterior talocalcaneal joint was found in 2 cases of old and 2 of recent injury. In 1 instance of recent injury, leakage of the contrast medium occurred through

Fig. 1

Fig. 2

fractures out into the normal structures. Normal arthrograms were obtained in 26 cases.

This article is well illustrated. Figure 1 demonstrates rupture in the capsule and ligaments on the lateral side of the ankle joint, with leakage of contrast medium into the soft structures. Figure 2 demonstrates a rupture on the medial aspect of the ankle joint, associated with leakage into the soft tissues, in a patient who also had a fracture of the distal end of the fibula. HAROLD C. OCHSNER, M.D.

**Fray, W. W.: Roentgen Manifestations of Arteriosclerosis of the Branches of the Abdominal Aorta; Calcification of Branches of the Celiac Axis.** *Radiology*, 1941, 36: 439.

It is the purpose of this article to show how varied the roentgen picture may be in connection with calcification of the arteries in the left upper quadrant and to suggest the means by which a correct diagnosis may be made. Anatomical details of the various vessels commonly undergoing calcification are presented. Detailed case histories are cited of patients presenting various types of calcifications. The cases have been divided as follows: (1) cases showing multiple ring or tubular shadows; (2) cases showing multiple crescentic or curvilinear shadows; and (3) cases showing single ring, tubular, crescentic, or curvilinear shadows.

In his discussion the author states that the recognition of the shadows described as evidence of advanced arteriosclerosis of the celiac axis, a diagnosis frequently missed, is not difficult if the common variations in the shape of these calcifications and the usual location of the shadows on the abdominal film are kept in mind. He also calls attention to the value of roentgen examinations in the lateral projection in differentiating the shadows from urinary concretions or other questionable lesions.

The following conclusions are made:

1. Calcification of the arterial walls of the celiac axis is frequently observed in elderly subjects.
2. The location of the shadows is typically over the left upper quadrant, the proximal branches lying at the level of the dorsolumbar junction while the more distal branches vary widely, shifting in position with the organ supplied.
3. The calcification produces shadows of diverse shapes, varying from short crescents to complete rings. Straight plaques alone are rarely observed.
4. While the branches of the celiac artery serve the organs of both upper quadrants, calcification over the right upper quadrant (hepatic branch) is rarely identified.
5. Over the left upper quadrant the calcification is commonly multiple, a score or more lesions being observed in one of the series.
6. A calcified aneurysm may be identified under favorable circumstances.
7. Identification of these shadows is important, since diagnostic confusion may lead to needless instrumental procedures in some instances, and in rare cases of ruptured aneurysm a missed diagnosis may postpone a needed operation.

ADOLPH HARTUNG, M.D.

**Yunich, A. M., and Crohn, B. B.: Atypical Regional Ileitis; Roentgenological Limitations.** *Am. J. Digest. Dis.*, 1941, 8: 185.

In the majority of cases of ileitis the disease can be diagnosed from the history, and this diagnosis can be confirmed roentgenographically without difficulty. A small group of cases, however, because of atypical clinical or roentgenological features, presents interesting diagnostic problems. The greatest problem was presented by those early cases with a good clinical picture but with negative or insignificant roentgenographic changes. In certain cases atypical clinical features have befogged the issue; in others, misinterpretation of roentgenographic findings (error of commission) has led to faulty conclusions; in others, the lack of roentgenographic confirmation of the disease (error of omission) has left the maker of a provisional diagnosis in the lurch.

A number of case histories illustrating the various reasons for errors in diagnosis are presented in detail with comments as to how they might have been obviated. The authors believe that diagnosis on purely clinical grounds is warranted and that when made, exploratory laparotomy should be insisted upon, even when there is insufficient roentgenographic corroboration. ADOLPH HARTUNG, M.D.

**De Araujo, A., and Osborne, C.: Roentgen Therapy in Scapulohumeral Periarthritis** (Da radiotherapia na peri-arthrite escapulo-humeral). *Rev. brasil. de orthop. e traumatol.*, 1941, 2: 235.

Having had very good results from deep roentgen therapy in deforming arthrosis and arthritis, the authors decided to try this method of treatment in scapulohumeral bursitis and periarthritis.

They give case histories illustrated with roentgenograms of 14 cases in which this method was used. They found the results better than those of any of the other methods which they had used previously. Pain which was the most troublesome symptom was almost always overcome in 2 treatments. Three or 4 treatments were given in all the cases except 1 particularly stubborn one, in which 6 treatments were given; the individual doses in this case were larger and it was the only case in which good results were not obtained. The opaque calcified nuclei around the joint either disappeared in all the other cases or were greatly reduced in size.

Irradiation was given over two fields, one anterior and one posterior, and occasionally another lateral field was used. The fields were 8 by 8 cm. in size. A dose of from 100 to 120 roentgens was given once or twice a week. The length of each treatment varied from six to twelve minutes. The technique used was 180 kv., 5 ma., filter 0.50 mm. of copper and 2 mm. of aluminum. The focus-skin distance was from 35 to 40 cm., the shorter distance being preferred.

AUDREY G. MORGAN, M.D.

**Warren, S.: The Radiosensitivity of Tumors.** *Am. J. Roentgenol.*, 1941, 45: 641.

The author, in considering the radiosensitivity of tumors, somewhat arbitrarily places them in three groups: (1) radiosensitive tumors which regress strikingly or disappear clinically with a total dose of 2,500 roentgens or less of protracted radiation; (2) radioresponsive tumors which require from 2,500 to 5,000 roentgens for similar regression; and (3) radioresistant tumors which require over 5,000 roentgens for response. In the first group the dosage given rarely causes appreciable damage to normal tissue; in the second group the normal tissue shows definite reaction but recovers without severe permanent injury; and in the third group damage to the normal tissue may equal or even exceed that done to the tumor.

Radiosensitivity and radiocurability are not synonymous. Tumors that metastasize readily may prove incurable in the end despite their radiosensitivity. Moreover, radiosensitivity is not necessarily a permanent, unchanging characteristic of a tumor. The metastasis from a radioresistant tumor, for example, may appear quite radiosensitive. On the other hand, there is a marked tendency for recurrences to be more resistant to irradiation than was the initial tumor.

Radiosensitivity does not depend on the tumor alone, but is affected as well by the character of the supporting tissue, its degree of vascularity, and even by the presence or absence of infection. While it may be said, generally, that the less the differentiation of the cells, the greater the radiosensitivity of a given tumor, and *vice versa*, this is not always correct. Therefore, the histological grading of malignancy, although of some assistance in estimating radiosensitivity, is not of great practical applicability.

The author, instead of merely cataloging the various tumors according to their degree of radiosensitivity, considered examples of different types of response, paying special attention to those concerning which there is some disagreement as to the criteria of the radiosensitivity.

Such examples in the first group are myelogenous leucemia and the rather heterogenous lymphomas; in the second group, the basal carcinomas of the skin, epidermoid carcinomas of the cervix uteri, and carcinomas of the larynx; and in the third group, carcinomas of the breast, carcinomas of the stomach, and the malignant melanomas of the skin.

In selecting these rather varied types of tumors for discussion, the author, from experience gained in the post-mortem and operating rooms, aims to stimulate further observation and experimentation to finally settle the question of best therapeutic approach.

T. LEUCUTIA, M.D.

**Ahlbom, H. E.: The Results of Radiotherapy of Hypopharyngeal Cancer at the Radiumhemmet, Stockholm, from 1930 to 1939.** *Acta radiol.*, 1941, 22: 155.

At the Radiumhemmet all carcinomas situated in the external portions of the larynx and in the hypopharynx are regarded as hypopharyngeal cancer. No distinction is made between extrinsic and intrinsic laryngeal cancer on the one hand and hypopharyngeal cancer on the other. The borderline between larynx and hypopharynx is drawn at the laryngeal inlet. Also included in the hypopharyngeal lesions are those carcinomas which show a fusiform growth with the center about the level of the transition between the hypopharynx and esophagus.

The series of cases of hypopharyngeal cancer studied by the author had been seen over a period of ten years, and included 129 women and 105 men. The author regards sideropenia as the predisposing factor in the female patients, practically all of whom had postcricoid lesions. In male patients the lesions were in the sinus pyriformis, the aryepiglottic folds, the posterior arytenoid regions, and on and around the epiglottis. Most of the male patients were chronic alcoholics and heavy smokers.

Small, relatively well demarcated tumors without lymph-node metastases or with an occasional small metastasis were treated with teleradium therapy, while the more extensive lesions were treated with roentgen therapy. There has been much variation in the teleradium treatment technique. The usual type of treatment has been irradiation of two fields on each side of the neck with from 3 to 5 gm. of radium for an hour and a half to two hours daily. The total dosage is not given, but the author states that a scaling or partially exudative dermatitis usually developed in about three weeks. Teleradium therapy is also used to supplement previous roentgen therapy.

There has been a considerable variation in roentgen therapeutic methods in the series studied. After 1936, three fields were usually treated, one on each side, and one on the back or front of the neck. The technical factors were 170 to 180 kv., ½ mm. of copper plus 1 mm. of aluminum, or thoraeus for filter; from 50 to 60 cm. of distance, and an intensity of from 20 to 30 roentgens per minute. From 150 to 400 roentgens, measured with back scatter, were given to one field daily. A total tumor dose of from 5,000 to 6,000 roentgens was usually given over a period of from twenty to thirty days. From two to four weeks after the beginning of the treatment an epithelitis with a fibrinous coating appeared in the mucous membrane of most patients. In the majority, only a dry epidermitis or exudation developed in the field of treatment, and this healed in from one to three weeks.

Of the 291 cases of hypopharyngeal cancer treated, 56 or 19 per cent were not treated by irradiation. The results of treatment in the irradiated group of 235 cases were cure with "absolute healing" in 6 per cent after five years. The patients treated with teleradium therapy were free of signs and symptoms after five years, while roentgen therapy gave five-year cures in about 5 per cent. Of the relatively few cases which came to autopsy, 10 showed no cancer in the throat or in the lymph nodes of the neck.

The total tumor dose over a certain number of days appears to be the factor of decisive significance in irradiation of hypopharyngeal cancer. The cases which remained cured for three years or more are practically all in the group which received from 5,000 to 6,000 roentgens over a period of from twenty to thirty days. Only palliative results were obtained in the cases which were given a smaller amount of irradiation. A strikingly large number of the patients who had received larger doses died during or immediately after the mucous-membrane reaction from the treatment.

The author concludes that the optimum roentgen treatment of these lesions is from 1,000 to 2,000 roentgens to a posterior port, and from 3,000 to 3,200 roentgens to each of two lateral ports, in daily increments of from 325 to 350 roentgens.

HAROLD C. OCHSNER, M.D.

**Stone, R. S., and Robinson, J. M.: Roentgen Irradiation of the Pelvis in Carcinoma of the Cervix Uteri.** *Radiology*, 1941, 36: 521.

In this article the authors present the details of their present manner of treatment in carcinoma of the cervix uteri together with their reasons for adopting the technique now in use. They maintain that irradiation of the neoplasm requires knowledge not only of the site of the primary lesion but also of all of the structures to which it may spread. A complete investigation, including urography, ought to precede plans for treatment.

If the lesion in the cervix is small and well localized, the first treatment with radium is given immediately after the biopsy and a complete course of radium therapy is carried out. If the growth has been classified as of Stage I or early Stage II (Schmitz) and the patient is a good operative risk, a Wertheim operation is then performed. Otherwise, a course of x-ray therapy follows the radium therapy.

If, however, the growth is bulky and extensive, the course of x-ray treatments is given first. This is followed in from two to six weeks, according to the condition of the patient, by radium therapy. The purpose of using the x-rays first is to decrease the size of the lesion so that the radium can be applied more effectively. The radium therapy is considered the principal method of treatment of the primary lesion. The beam of roentgen rays is not aimed at the cervix, but at the probable regions of extension and metastasis. The location and size of the fields to be used and the direction of the beam depend, therefore, on the location of those structures beyond the reach of the gamma rays which are likely to be involved, namely, the lymph channels, lymph nodes, parametrium, and vagina. A detailed anatomical description of these structures is included together with the most likely course metastatic extension is apt to follow as reported by various authors.

As regards the technique used, individual findings determine the actual details. Routinely, two fields anteriorly and two posteriorly are employed. When the patient is more than 20 cm. in thickness, right and left lateral fields are usually added. When 200 kv. x-rays are used, the standard daily dose is 200 roentgens in air to an anterior and a posterior port on the same side of the pelvis one day, and to the ports on the opposite side the next day. When lateral ports are used they are usually treated every third day. The treatments are continued daily except Sundays and holidays, the ports being rotated in the manner mentioned, until each port has received 1,900 roentgens. If it is judged that the patient can tolerate more, treatment is continued until a dose of 2,300 or even 2,700 roentgens has been directed to each port.

With the 200 kv. constant potential apparatus, a filter of 0.5 mm. of copper plus 1.0 mm. of aluminum is used, and the half-value layer in copper of the rays is 1.05 mm. The rate of administration is 21.3 roentgens per minute, and the distance 80 cm. When the 1,000 kv. Sloan high-frequency apparatus is used, the quality of the radiation changes to 9.5 mm. of copper half-value layer, and the rate to 25 roentgens per minute. The distance remains the same. From 300 to 325 roentgens in air are given, and treatment is carried to totals of between 3,250 and 3,750 roentgens.

For the last two years the right side of the pelvis of each patient has been treated with 200 kv. radiation and the left side with 1,000 kv. radiation. This was done for the purpose of comparing the reactions in the skin produced by the two qualities of radiation and has been reported. Some of these patients have had Wertheim operations and some have had removal of the pelvic lymph nodes. The gynecologists have been unable to determine any difference in the reactions of the intrapelvic tissues to the different qualities of radiation.

Detailed discussion of the rationale of the technique used is included and reasons are given for variations from procedures reported by others. The results obtained are given consideration only insofar as technical factors are involved.

ADOLPH HARTUNG, M.D.

## RADIUM

**Kaplan, I. I.: Radium-Beam Therapy.** *Am. J. Roentgenol.*, 1941, 45: 683.

In 1930 Bellevue Hospital, New York, New York, was supplied with a 5 gm. radium pack. Its original construction was described the following year. Since then several changes had to be made to decrease the stray radiation received by the operator without sacrificing the flexibility of the pack. Braestrup recently designed a remote control arrangement, which is described and illustrated in the original article. This arrangement permits the removal of the radium by means of a flexible metal conveyor chain behind a 3 cm. lead block when not in use. The chain is operated by an electric motor controlled from the operator's position by a push-button system. The treatment with the pack is given in a specially constructed lead-lined room, the operator being outside behind a lead barrier and observing the patient through a lead window. After the holder is positioned for treatment, the operator moves outside of the treatment cubicle behind the lead barrier and only then is the radium automatically placed into the exposure portal by means of the remote-control arrangement. The apparatus includes an electric timer so that at the end of the treatment, the radium is again automatically brought back into a position of safety behind the 3 cm. lead block.

Various other features are incorporated in the new pack arrangement which are briefly described. Of particular interest is the distribution of the radium tubes by having them form an arc with a radius of 11 cm. and the center of the arc falling 5 cm. below the skin, which is the average depth of the lesions treated with the pack. Since there are 100 radium tubes altogether, they are placed in two layers in such a way that the lower tubes do not shadow the upper tubes at the depth of from 4 to 8 cm., although at the surface the intensity from the upper tubes is reduced somewhat. The result of this arrangement is a greater depth dose.

The clinical dosage was worked out on an empirical basis. It was found, for example, that a daily dose of 5,750 mgm.-hours over an 8 by 10 cm. portal and at a 6 cm. radium skin distance produces cutaneous and mucosal reactions equivalent to those obtained with a daily dose of 400 roentgens produced by 200 kv. with a 0.5 copper screen with backscattering. As a whole, the gamma rays of radium produce certain biological effects with a smaller physical dose than is required of the roentgen rays. This is an advantage of the radium-beam therapy. It has also been observed that the gamma erythema appears at a much later date and lasts longer than the roentgen erythema, although severe second and third-degree reactions occur at approximately the same time.

In planning treatment with the pack, the aim is to deliver as adequate and homogeneous irradiation as possible. Although very large doses can safely be administered, in some unfortunate instances necrosis did occur, especially when the primary carcinoma was associated with infection.

The total number of cases treated with the radium pack during the past five years amounted to 447, with all types of malignancies included. Ten of the more representative cases are briefly reviewed and 3 are illustrated with photographs taken before and after treatment.

The general conclusion is reached that the results obtained warrant the continuance of this form of treatment. In localized lesions complete regression often follows, and in some instances of metastases to the regional lymph nodes gamma-beam therapy produces results heretofore achieved only by radical mutilating surgery. T. LEUCUTIA, M.D.

**Heyman, J., Reuterwall, O., and Benner, S.: The Radiumhemmet Experience with Radiotherapy in Cancer of the Corpus of the Uterus.** *Acta radiol.*, 1941, 22: 11.

This article is in fact a monograph dealing *in extenso* with the various clinical aspects and treatment of carcinoma of the corpus uteri as experienced at the Radiumhemmet of Stockholm. The material referred to includes a total of 402 cases treated between 1914 and 1934, inclusive. The article is divided into four chapters.

The first chapter concerns the classification of uterine cancer. The carcinoma of the corpus uteri includes carcinoma of the fundus and body of the uterus, whereas the carcinoma of the collum uteri includes carcinoma of the cervix and of the vaginal portion.

In reviewing all the cases for the present article, the authors were surprised by the greater number of cases of uterine cancer which could not be properly divided into the corpus or collum carcinoma subgroups without seriously impairing the diagnosis. They found that often both portions of the uterus or even other pelvic organs were involved concomitantly, and therefore they proposed three other subdivisions, such as: carcinoma of the corpus and collum uteri; carcinoma of the uterus and ovary; and carcinoma of the pelvis. It is interesting that in the period from 1914 to 1940 no less than 172 cases were found to be carcinoma of the corpus and collum uteri, 68 cases carcinoma of the uterus and ovary, and 11 cases carcinoma of the uterus and several pelvic organs. None of these cases is included in the material of the present article.

The second chapter is about carcinoma of the corpus uteri. In this chapter, the authors discuss in detail the following:

*The Radiumhemmet classification and method of examination.* The classification refers to the grouping of the cases according to the clinical stage and therapeutic procedure. In the method of examination special emphasis is laid on the so-called fractional curettage. This is practiced with the view in mind of obtaining a correct classification with regard to the true origin of the carcinoma. First, the lower cervix, immediately above and around the external os, is scraped; second, after dilatation of the cervix and sounding of the uterine cavity, the uterus canal forceps is introduced and several tissue specimens are removed from the fundus; third, the cervical canal and internal os are curetted with a large curette; and fourth, the corpus cavity is curetted by means of the uterus canal forceps. The four types of specimens obtained are placed in separate compartments of a specially constructed tissue holder box to avoid mixing.

*The Radiumhemmet method of treatment.* The first method discussed is intra-uterine radium application. Until 1930, a single tube of from 35 to 45 mgm. of radium element was introduced into the uterine cavity. This method, however, was found unsatisfactory and therefore arrangements were gradually made to have several tubes used, especially when the uterine cavity was larger than average. The present method, which has been employed routinely since September, 1939, consists of packing the uterus with a number of 8 mgm. radium tubes, 20 mm. in length, 2.8 mm. in outer diameter, and 1 mm. in equivalent lead wall thickness. In very large uteri as many as 20 tubes are packed, the distribution conforming to the individual circumstances. On the basis of previous clinical experience the dose is established as 1,500 mgm. element hours, given twice with an interval of three weeks. At each treatment the patient remains in the hospital for four or five days. The technical procedure is described in lengthy detail and richly illustrated, especially as it regards the process

TABLE I.—ABSOLUTE AND OVER-ALL RELATIVE CURE RATE IN THE TREATMENT OF CORPUS CANCER AT THE RADIUMHEMMET 1914 TO 1934 INCLUSIVE, ESTIMATED AFTER A PERIOD OF FIVE AND TEN YEARS, RESPECTIVELY, DATING FROM THE BEGINNING OF THE TREATMENT. THE TEN-YEAR FIGURES ARE PLACED IN BRACKETS.

| | | | |
|---|---|---|---|
| (a) | Total number of patients examined | 416 | (188) |
| | Total number of patients treated | 402 | (180) |
| | Number of patients alive without evidence of the disease, including those operated upon after failure of radiotherapy | 190 | ( 60) |
| | Absolute cure rate | 45.7% | (31.9%) |
| | Relative over-all cure rate | 47.3% | (33.3%) |
| (b) | Number of patients alive without evidence of the disease, excluding those operated upon after failure of radiotherapy | 161 | ( 45) |
| | Absolute cure rate | 38.7% | (23.9%) |
| | Relative over-all cure rate | 40.0% | (25.0%) |

of sterilization of the containers and the checkup roentgenograms of the pelvis.

Vaginal radium application, teleradium, and roentgen treatment are then discussed. These are used only in special cases when the carcinoma has involved the upper vagina and the inguinal glands and when the uterus is fixed. The technique varies considerably.

In estimating the final results, in addition to the three groups already mentioned, the following cases were excluded: patients previously operated upon or treated elsewhere by irradiation, and patients with lacking or inclusive microscopic diagnoses. In this manner, the figures obtained represented values for the radiotherapy alone. They are expressed in Table I.

These over-all results are dissected into various group results according to clinical and technical operability or inoperability, and different methods and periods of treatment.

The choice between operative or radiological treatment is then discussed, but the authors' view in this respect is not clearly defined as yet.

In the third chapter the histological classification is discussed. This chapter was written by Reuterwall on the basis of a revision of the microscopic findings in all of the cases. The histological grouping is given herewith.

PLAN FOR THE HISTOLOGICAL GROUPING USED IN THE REVISION OF THE RADIUMHEMMET SERIES OF CARCINOMA OF THE CORPUS UTERI

Group I —Papillary adenocarcinoma.
Group II —Very highly organized and differentiated adenocarcinoma of the adenoma malignum type.
Group III —Highly organized and differentiated adenocarcinoma.
Group IV —Less highly organized and differentiated adenocarcinoma, up to one-third solid.
Group V —Adenocarcinoma with squamous epithelial areas.
Group VI —Adenocarcinoma of slight organization and differentiation, more than one-third solid.
Group VII —Solid carcinoma without differentiation to squamous epithelium.
Group VIII—Squamous epithelial carcinoma plus solid carcinoma with portions differentiated to squamous epithelium.
Group IX —Uncertain cases in which there was well founded reason to suspect cancer.
Group X —Carcinosarcoma and mixed tumors.
Group XI —No microscopical preparations to be had.
Group XII —No demonstrable cancer in the microscopic sections.
Group XIII—Cases left unclassified for one reason or another.

Numerous photomicrographs are used for illustration.

In the fourth chapter the physical determination of the dosage and treatment times required in the packing method are discussed. This chapter in turn was written by Benner. It deals with difficult problems of dosage measurement of various radium intensities. Since the number of radium tubes to be used depends on the size of the uterine cavity, it is important to know the intensity distribution in the individual case. To determine this, the author performed a series of experiments with chamois leather bags of different sizes and shapes conforming to situations as found in the radium-packed uterine cavity. The average intensities in Imc, the treatment times, and the total mgm.-hours for different numbers and sizes of radium irradiators were tabularly arranged.

T. LEUCUTIA, M.D.

# MISCELLANEOUS

## CLINICAL ENTITIES—GENERAL PHYSIOLOGICAL CONDITIONS

**Stewart, C. P.: Nutritional Factors in Dark Adaptation.** *Edinburgh M. J.*, 1941, 48: 217.

This article summarizes the literature and presents important data concerning dark adaptation.

The term "dark adaptation" connotes the acquirement, during the time spent in the dark, of the power to appreciate consciously low light intensities or dimly lit objects. In individual cases this could be changed by the deprivation or provision of Vitamin A. Indeed, the author emphasizes that in many subjects whose tests were good, still further improvement followed a daily supplement of 6,000 I.U. of Vitamin A for three or four weeks.

These findings establish positively the direct effect of Vitamin A on the dark adaptation of certain subjects at certain times, and experimentally, that Vitamin A is one of the physiological factors in this process. However, the prediction of individual response to Vitamin A was impossible. There was no correlation between the intake of Vitamin A and the rate of dark adaptation, nor was it possible to find any level of vitamin intake above which dark adaptation was invariably good, or any below which it was invariably bad. This lack of quantitative statistical correlation does not mean that Vitamin A is unimportant in dark adaptation as some authors have concluded. It means that there are other factors involved in dark adaptation in addition to Vitamin A. These factors were found to be age, fatigue, digestive efficiency, minor infections, and Vitamin C. Probably still other specific nutritional as well as non-specific general biochemical factors are also involved. PAUL STARR, M.D.

**Anderson, E. R., Karabin, J. E., Udesky, H. L., and Seed, L.: The Oral Administration of Synthetic Vitamin K (2-Methyl-1, 4-Naphthoquinone).** *Surgery*, 1941, 9: 361.

The authors determined prothrombin by Smith's "bedside" method. They found it reduced in jaundiced patients, but the reduction did not correlate with the degree or duration of the jaundice. It was also reduced in a number of surgical patients who were not jaundiced, but it was not diminished in a number of others that were jaundiced. Oral administration of 2-methyl-1, 4-naphthoquinone combined with bile salts elevated the prothrombin to normal in all cases. The response to this oral administration occurs in less than one hour but it does not occur unless bile salts are administered with the vitamin. The rise in prothrombin activity following a single dose was maintained in some cases for only twelve hours, in others for three days, and in some, indefinitely. The maintenance dose recommended is 2 mgm. three times a day.

Patients who have a normal prothrombin time pre-operatively may have a serious drop postoperatively whether jaundiced or not. The reduction was apparent at the third day and was observed to progress in 3 patients not given treatment until the seventh postoperative day.

No nausea or vomiting or toxic effects were observed following large doses of the synthetic compound. PAUL STARR, M.D.

**Clark, W. G.: Vitamin B Complex and Adrenalectomy.** *Endocrinology*, 1941, 28: 545.

Relatively massive doses of non-toxic thiamin hydrochloride and its pyrophosphate, cocarboxylase, which were administered parenterally and orally, exerted no beneficial effects on the appetite, the average daily weight loss, or the survival of adrenalectomized rats maintained on a diet adequate for normal rats; nor was there a difference in action between the thiamin and the cocarboxylase.

The same conclusion was reached in the case of orally and parenterally administered riboflavin, and parenterally administered sodium phosphate ester of riboflavin in adrenalectomized rats and guinea pigs.

The same conclusion was also made for parenterally administered sodium nicotinate, and parenterally or orally administered pyridoxine; for dietary supplements of a grass concentrate high in thiamin, riboflavin, nicotinic acid, Factor W, and the $B_6$ complex; and for a liver concentrate high in nicotinic acid, riboflavin, pantothenic acid, and filtrate fraction. Parenterally and orally administered pantothenic acid, with and without massive doses of riboflavin, and parenterally administered Factor W concentrate likewise exerted no effects.

These results warrant the following conclusions:

1. If there is a relation between the adrenal cortex and thiamin or riboflavin, it is not because these substances are phosphorylated and subsequently effective only if the adrenal cortex is present, since the phosphorylated forms have no effect after adrenalectomy.

2. Excessive but non-toxic administration of most, if not all, of the members of the Vitamin B complex has no effect on appetite, weight maintenance, clinical appearance, or survival of adrenalectomized rats which are given diets adequate for normal rats.

3. The Laszt and Verzar theory that adrenal insufficiency is a "secondary avitaminosis" is untenable in the light of these and other results.

PAUL STARR, M.D.

**Sydenstricker, V. P.: The Clinical Manifestations of Nicotinic-Acid and Riboflavin Deficiency (Pellagra).** *Ann. Int. Med.*, 1941, 14: 1499.

The author discusses the biochemical mechanisms of oxidation, indicating that the three vitamins—

thiamin, nicotinic acid, and riboflavin—are used in the continuous process of cellular nutrition. The symptoms and signs of avitaminosis may be regarded as results of chemical disturbances of cellular function. The fundamental relationship shown in these clinical manifestations is the effort of the body to derive energy from carbohydrates in excess of the available supply of vitamins. Hence, any factor which creates an increased demand for the utilization of energy may precipitate the clinical manifestations of avitaminosis by causing the rapid depletion of coenzymes. Such conditions are unaccustomed work, fever, pregnancy, hyperthyroidism, and the substitution of alcohol or parenteral glucose for food.

The mechanism and treatment of pellagra are discussed, as well as riboflavin deficiency and its therapy. It is emphasized that an adequate balanced diet is most necessary and that it is particularly important to refrain from treating presenting symptoms due to a superimposed single avitaminosis with large amounts of the specific vitamin. This specialized therapy is almost certain to precipitate the manifestations of coincident subclinical deficiencies of other members of the group.

PAUL STARR, M.D.

**Chunn, C. F., and Harkins, H. N.: Experimental Studies on Alimentary Azotemia. The Role of Blood Absorption from the Gastro-Intestinal Tract.** *Surgery*, 1941, 9: 695.

A review of the literature by the authors disclosed that an increase in the nitrogenous elements of the blood is regularly observed in gastro-intestinal hemorrhage, when the blood passes down through the intestinal tract. The degree of the azotemia appears to be in direct proportion to the amount of blood in the gastro-intestinal tract and, to some extent, depends on how long the blood has been there. There have been theories propounded that the azotemia is due to the decreased renal blood flow. Others believe that the changes in the electrolyte balance and the element of shock must be considered in the pathogenesis of the urea retentions. Certain authors maintain that the factors of importance are the loss of blood and the increased absorption of blood from the gastro-intestinal tract which causes an increase in body protein.

Chunn and Harkins placed citrated beef blood into the stomachs of a series of dogs by means of a tube. Blood-urea-nitrogen curves were then drawn from the results of repeated examinations of the blood from the jugular vein. The result was a definite rise in the blood-urea-nitrogen in all of the dogs, free from the elements of anemia, hemorrhage, shock, and the factors of starvation, dehydration, or hypochloremia. The authors, therefore, conclude that the azotemia is due to the products of absorption of the blood. They suggest the name of alimentary azotemia for this, correlating the term with elementary glycosuria, in which the mechanism is similar.

WILLIAM C. BECK, M.D.

**Calvin, D. B.: Plasma Volume and Plasma Protein Concentration After Severe Hemorrhage.** *J. Lab. & Clin. Med.*, 1941, 26: 1144.

Researches have suggested a possible increase in total circulating plasma protein shortly after severe hemorrhage. From work previously reported it is known that in hydremic plethora extra protein may enter the vascular system from some source in the body, possibly the liver. Similar changes have been observed with increased plasma volume, following the use of diuretics in the treatment of edema from circulatory failure and cardiac decompensation. The author presents a review of experiments using large dogs.

Three types of preparation were employed: (a) dogs without food or water for forty-eight hours prior to hemorrhage; (b) dogs which had water but no food twenty-four hours prior to hemorrhage, then were given 500 ml. of 0.7 per cent sodium-chloride solution by mouth one hour prior to hemorrhage; and (c) dogs which had water but no food twenty-four hours prior to hemorrhage, with the injection into the jugular vein of enough 0.9 per cent sodium-chloride solution to equal the volume of whole blood withdrawn, immediately after withdrawal.

The hemorrhage from the carotid artery was 25 per cent of the dog's blood volume (as previously determined) within five minutes.

The plasma volumes and plasma protein concentrations were tested according to the newer techniques and the following conclusions were drawn:

1. Following subacute hemorrhage in dogs, there is a compensatory movement of fluid from the tissues to the plasma.
2. The degree of compensation depends, in large measure, on the water balance of the body prior to hemorrhage.
3. Proteins enter the vascular system along with the fluid.
4. The protein entering the vascular system is primarily albumin.

PAUL MERRELL, M.D.

**Neuwelt, F., Levinson, S. O., and Necheles, H.: Studies on Shock. Variability of the Shock Syndrome in Toxic Drug Shock.** *Surgery*, 1941, 9: 503.

Animal experiments were performed in which profound shock was produced by various means. The main criteria employed in determining and evaluating the severity of shock were low blood pressure, acidosis, as expressed by blood carbon dioxide, and hemoconcentration, as expressed by hemoglobin values. The blood pressure reflects the state of vasomotor tone, the blood carbon dioxide the state of tissue oxygenation (and indirectly the adequacy of the peripheral circulation), and the hemoglobin values indicate the plasma-cell ratio and changes in the degree of capillary permeability. In non-anesthetized animals the additional clinical symptoms of prostration, labored respiration, defecation, and urination, were recorded. The authors were impressed by the observation that an animal could present the

typical clinical picture of shock without the presence of all three criteria stated above; also that no one of these criteria by itself could be expected to indicate the presence or degree of shock. In a number of experiments it was observed that no appreciable hemoconcentration occurred despite death of the animal from experimental shock; whereas, in other experiments definite hemoconcentration developed during shock and yet the animal recovered from a state which might be classified as extremely severe when judged by the degree of hemoconcentration.

The authors employed various drugs in order to produce shock: histamine, peptone, croton oil, with anesthesia. There was no constancy in the effects of these drugs when used on anesthetized and unanesthetized dogs, nor was there any constant correlation between the dose of the drug and the production of shock in the individual animal in 46 experiments.

From these experiments, the authors came to the following conclusions:

The production of shock by histamine, croton oil, and peptone is extremely variable both in anesthetized and unanesthetized dogs. No correlation seems to exist between the degree of shock and dosage of drug employed in different dogs. Even when profound shock is produced, changes in blood pressure, alkali reserve, and extent of hemoconcentration vary widely from experiment to experiment. Profound or even fatal capillary shock may occur without the development of hemoconcentration at any stage of its course. SAMUEL H. KLEIN, M.D.

**Quill, L. M., and Marting, E. C.: Epiloia.** *Surgery*, 1941, 9: 581.

Epiloia is a clinical syndrome characterized by mental deterioration, epilepsy, adenoma sebaceum of the skin, and tuberous sclerosis of the brain. Other features inconstantly associated are benign tumors of the liver, spleen, kidney, heart, gastroenteric tract, retina, lung, thymus, thyroid, uterus, urinary bladder, and nail beds. Epiloia is described by Sherlock as a heredofamilial degeneration, and a family psychopathic history is sometimes obtainable.

The onset of the disease is manifest in infancy or early childhood. Idiocy is a common finding. Epileptic seizures begin at an early age, but the type is difficult to predict. The facial lesions appear within the first decade. Death occurs at an early age, but the mortality is in direct relationship to the extent of the mental deficiency, the development of the brain lesions, and the possible presence of visceral neoplasms. The brain lesions are found in the cortex and immediately beneath the ependyma projecting into the lateral ventricles. The tumors are present in multiple areas and the potato-like appearance is unmistakable. Microscopically, these tumors are composed of a neuroglial proliferation and large giant cells of glial origin.

Adenoma sebaceum is a nodular eruption of red or brown color distributed over the face. It starts in the nasolabial folds and extends over the cheeks in butterfly pattern. Nail-bed tumors are filiform papillomas or fibromas and are located at the nail cutaneous juncture on the fingers and toes. The size may vary from that of the small filiform-shaped tumor to the golf-ball size of tumor. In some instances the nail-bed tumors give rise to pain and discomfort, especially if secondary infection and hemorrhage occur. Microscopically, the tumors are composed of a surface layer of heavily keratinized stratified squamous epithelium. The underlying layer consists of a well differentiated and sometimes hyalinized fibrous connective tissue in which an occasional fibroblast can be seen. Surgical removal is indicated if the tumors are giving rise to pain; they do not recur following adequate surgical removal.

The study discloses that if the patient with epiloia lives through puberty and is capable of mating, transmission of the disease is possible. It was also found in this study of several cases in one family that the disease is not a recessive characteristic but a dominant characteristic.

The direct transmission of the disease from parent to offspring through three generations, as presented by this study as well as by that of Kirpiznik, proves that the syndrome is truly hereditary, i.e., genotypical. HOWARD A. MCKNIGHT, M.D.

**Nannini, M. C.: Late Results of Vaselinoma** (Gli esiti lontani del vasellinoma). *Policlin.*, Rome, 1941, 48: sez. prat. 524.

Vaselinoma is a tumor produced by the injection of oils, which must be considered in deciding claims for damages and exemption from military service.

A case is described in a man who suffered a slight gunshot wound of the right knee in 1915. He was invalided. Two years later he was given a military trial for having kept up an edema of the knee for the purpose of obtaining release from military service. He was released because of lack of sufficient proof. At the end of the war he resumed his work as a shoemaker. In 1920 he applied for a pension on account of the war wound. His application was refused because it was said his disability was not caused by the war wound but by his having injected irritating substances which had affected the knee-joint.

Now, twenty-three years after the injury, he shows a plaque of swelling covering the patella; it is hard and adherent rather loosely to the deep and periarticular tissues. In the posterior part of it there are a number of hard nodules varying from the size of wheat grains to that of hazelnuts which form cords running horizontally almost around the knee. The skin over the swollen area is bluish. The knee is larger than the opposite knee and the quadriceps smaller than the opposite one from atrophy. In the inguinal region there is a hard and painless packet of glands. Flexion of the knee is only 90°. Roentgen examination showed signs of arthritis and small calcified bodies around the joint. The picture was that of a tumor produced by the injection of oils.

The question of how such patients should be treated from the military point of view is discussed. They are not good military material and their

example may affect other men, but it does not seem that they should escape military duty by their self-inflicted injuries. AUDREY G. MORGAN, M.D.

**Tesoriere, A.: A Tumor with Granulosa Cells in a Girl Twelve Years of Age** (Tumore a cellule della granulosa in una ragazza dodicenne). *Policlin.*, Rome, 1941, 48: sez. chir. 75.

In 1890 Acconci described for the first time a papilliferous cystoma of the ovary in which there were masses of cells arranged in such a way as to resemble the normal follicles of the ovary. Because of the different histological findings many different names have been given to these tumors. The cells have an unmistakable resemblance to the normal cells. In some cases they are small and flat like those of the primordial follicles and in some so large as to resemble those in follicles undergoing luteinization. In these tumors structures have been described that resemble graafian follicles. No ova are found in these folliculoid structures.

The author describes a case in which such a tumor was found in a girl twelve years of age who had not yet menstruated. This was unusual as most of them are found in women past forty. This patient was a twin and comparison with her twin showed that the tumor had evidently had no effect on her sexual or bodily development. The tumor and the ovary and tube on that side were removed and the child was well a year later, at the time of this report. In women it is well to remove the uterus also in cases of these tumors.

There has been some discussion as to whether these tumors are benign or malignant. While they are not extremely malignant, it is not safe to consider them absolutely benign.

In this case giant cells were found in the body of the tumor, at two different times, which confirmed the hypothesis of the connective-tissue origin of these cells. AUDREY G. MORGAN, M.D.

**Erikson, S.: Nævus Epithelioma Cylindromatosus, with Special Reference to Its Radiological Treatment.** *Acta radiol.*, 1941, 22: 217.

Under the term epithelial nævus are included several closely related types of tumor, the genesis and mutual relationship of which have given rise to lively discussion during the last few decades. One of these tumor types is nævus epithelioma cylindromatosus, the histology of which was first described in detail by Billroth under the term cylindroma, chosen on account of the characteristic structure with profuse hyaline material cylindrically disposed around epithelial strands. During the latter half of the nineteenth century this type was interpreted as sarcoma or endothelioma. Since then it has been described under a number of different names. In America it is referred to as benign epithelioma of the scalp, nævus epithelioma cylindromatosus, or turban tumor. In the French literature it is called epithéliome bénin du cuir chevelu, while in Germany it is usually described as cylindroma or nævus epithelioma cylindromatosus. As the latter term seems to characterize this tumor well, it is used by the author.

Nævus epithelioma cylindromatosus develops usually during the third and fourth decades but may also first appear in the middle of the second. The chief site of this tumor is the capitellum. Its size varies from the size of a pea to that of a small orange. It is usually semispherical in form and more or less elevated above the surrounding tissue. It is covered by skin of normal color in the case of the smaller lesions and bluish-red in the case of the larger.

The diagnosis of nævus epithelioma cylindromatosus would seem to offer no great difficulty in well developed cases. Confusion with multiple atheroma is scarcely possible. The family history, the large number and site of the tumors, the semispherical form, the tensely elastic consistency, and the bluish color would seem to be sufficient to prevent such confusion. The solitary types of nævus epithelioma cylindromatosus have been as large as brown beans, rather firm in consistency and bluish-red in color. They have not shown any certain typical clinical picture and the exact diagnosis cannot be obtained without a biopsy.

Nævus epithelioma cylindromatosus grows very slowly and aside from the cosmetic disadvantage the tumor causes very little or no discomfort. In the cases in which the tumors are larger and more widely distributed, treatment is indicated. An operative removal may be technically difficult or impossible if the nodules are numerous and close to one another. In such cases radiation with later surgical removal of the remnants seems to be indicated.

The author describes 8 cases of multiple nævus epithelioma cylindromatosus and 6 cases of the solitary type, all of which were treated at the Radiumhemmet in Stockholm. In 3 cases the tissues showed definite transitions between nævus epithelioma cylindromatosus and epithelioma adenoides cysticum. In 1 case the microscopic picture suggested that a nævus epithelioma cylindromatosus may have been transformed into a basal-cell cancer. The familial occurrence of nævus epithelioma cylindromatosus is stressed. One family tree presenting undoubted simple dominant hereditary transmission is submitted. In cases with widespread tumors in which operative treatment is difficult or impossible, good results have been obtained with radiation. The histological picture was completely altered by radiation and a pronounced hyalinization took place.

JOSEPH K. NARAT, M.D.

**Blum, H. F.: Sunlight and Cancer of the Skin.** *J. Nat. Cancer Inst.*, 1940, 1: 397.

Nearly fifty years ago, Unna described "seaman's skin" as a precancerous condition attributable to continued exposure to light. At present, opinions vary as to the relative importance of sunlight on cutaneous cancer.

Until quite recently, the evidence has been entirely clinical. The following conclusions have been reached by various workers: (1) cancer of the skin

occurs principally on parts exposed to sunlight; (2) cancer of the skin is more prevalent in outdoor workers; (3) the incidence of cancer of the skin is greater in regions of the earth which receive greatest insolation; and (4) cancer of the skin occurs more often in blonds than in brunets. These arguments seem valid enough at first, but on critical examination become less convincing. Their weakness lies chiefly in failure properly to evaluate the sunlight factor, which may be credited in great part to paucity of information regarding the incidence of sunlight upon, and penetration into, the skin. Much necessary information is still lacking, so that even today any analysis of this phase of the subject must be open to question.

In the past decade, strong support has come to the theory of direct causation of cancer by sunlight, from experiments on laboratory animals. These studies are important not only because they demonstrate that cancer can be produced by radiation of wave lengths present in sunlight, but also because they yield information which permits better evaluation of the evidence obtained from clinical study.

The author examines critically the interrelations of these various lines of evidence in order to provide a better understanding of the prosecution of further studies.

After a thorough discussion of the active wave lengths which cause tumor formation in experimental animals, and the incidence of sunlight upon, and penetration into, the skin, the author concludes that converging evidence from a number of sources indicates that sunlight is an important etiological factor in cutaneous cancer in human beings. However, the evidence is tenuous in most instances. The clinical evidence alone is suggestive, but that from animal experiments is necessary to lend solidity to the concept. Caution is necessary, however, in carrying over the evidence from these experiments to the case of man.

The determination of the wave lengths that produce tumors in experimental animals is a very important step in the solution of the problem. Since these are the same wave lengths that principally affect human skin, i.e., those shorter than 3,200 A, it seems probable that they, if any, play a role in human cutaneous cancer. Numerous tentative hypotheses regarding the mechanism of tumor production by radiation seem untenable because they require the participation of longer wave lengths.

Much more exact data, both clinical and experimental, are required to place the concept on a thoroughly sound footing.

JOHN E. KIRKPATRICK, M.D

**Pund, E. R., and Stelling, F. H.: Lymphosarcoma. Report of 3 Apparently Cured Cases.** *Am. J. Surg.*, 1941, 52: 50.

The pathological diagnosis of "lymphosarcoma" usually implies a fatal outcome. The life expectancy after diagnosis averages two years, from 85 to 95 per cent of the patients die before the expiration of five years, and survival for a period of ten years is extremely rare.

The authors report 3 cases with survival periods of six, eight, and eleven years, respectively. At the present time there is no evidence of the disease in any of the 3 patients. The diagnosis was made histologically and found support in clinical observation and gross study. Spontaneous regression occurred in a lymphosarcoma of the stomach after surgical relief of obstruction. Surgical removal of early lymphosarcoma of a lymph node resulted in a cure of 2 patients. None of the patients received adequate roentgen-ray therapy. JOSEPH K. NARAT, M.D.

**Allen, F. M.: Reduced Temperatures in Surgery (Surgery of the Limbs).** *Am. J. Surg.*, 1941, 52: 225.

The modification of the local tissue metabolism in experimental animals by changes in temperature has been observed to exert a remarkable effect on the survival of tissues with impaired circulation. The clinical applications of this principle may be numerous. The author wishes to advocate investigation of its use in the surgical treatment of diabetic and arteriosclerotic gangrene of the extremities.

Three ways of obtaining refrigeration were tried. The first method was to immerse the patient's leg in ice water to a level about 1 in. above the tourniquet. Subsequently this was modified and the extremity was placed on a layer of ice and covered completely with cracked ice. More recently, the limb was surrounded with ice bags. The temperature should be kept slightly above or below 5° C. to provide the desired refrigeration and yet avoid freezing of the tissues.

In the presence of a lowered temperature one may apply a tourniquet to diabetic and arteriosclerotic limbs for a reasonable length of time without producing serious or permanent damage to the blood vessels.

By refrigeration one may obtain complete anesthesia of all tissues of the leg or thigh, including the sciatic nerve, in a few hours. Instead of providing only anesthesia of the nerves, refrigeration inhibits all protoplasmic activity including the production of shock. In this manner one is permitted to operate in a bloodless field without fear of producing shock.

Immediately before operation the limb is removed from its ice bed to permit the usual pre-operative skin preparation. The refrigerated tissues will remain in that state long enough to permit the performance of any ordinary operative procedure. The tourniquet should be released just before the wound is closed. This permits a return of vascularity and identification of any unligated blood vessels.

Postoperatively the temperature must be reduced to whatever level may be necessary to keep the metabolic demand of the tissues for blood from exceeding the vascular supply. The temperature should be elevated as rapidly as possible where no vascular insufficiency exists.

By refrigeration the wound margins can be kept in close approximation for several days without heal-

ing and thus permit drainage without drains if desired. The wound does not decompose or become infected because the low temperature also inhibits the action of enzymes and bacteria. The wound margins can be made to agglutinate when desired by elevating the temperature. Although healing per primam is thus delayed, it is not otherwise interfered with.

A case is reported which illustrates the use of refrigeration in the treatment of advanced arteriosclerosis. EDWARD W. GIBBS, M.D.

## GENERAL BACTERIAL, PROTOZOAN, AND PARASITIC INFECTIONS

**Goldberg, S. L., and Bloomenthal, E. D.: Staphylococcic Septicemia.** *Surgery*, 1941, 9: 508.

Staphylococcus septicemia is a condition having a mortality, until very recently, averaging 76 per cent. In this article, the authors report a series of 32 cases with a mortality rate of 44 per cent.

As a rule, the cases with an acute and fulminating onset have a higher mortality rate. Of the various types of therapy employed in this series, the use of staphylococcus antitoxin and sulfapyridine gave the most direct evidence of favorably influencing the course of the disease. In the last 6 consecutive cases, all observed in 1939, the patients recovered. All of them received adequate doses of sulfapyridine, and 3 also received staphylococcus antitoxin.

There is clinical and experimental evidence to support the tenet that chemotherapy and serotherapy are synergistic in action and that both should be used in the treatment of staphylococcus septicemia. Early clinical diagnosis and the prompt institution of chemotherapy and serotherapy before corroboration of the diagnosis by blood culture is important. Supportive treatment and sound surgical measures are essential. SAMUEL H. KLEIN, M.D.

**Marshall, E. K., Jr., Bratton, A. C., Edwards, L. B., and Walker, E.: Sulfanilylguanidine in the Treatment of Acute Bacillary Dysentery in Children.** *Bull. Johns Hopkins Hosp.*, Balt., 1941, 68: 94.

The authors report observations on a group of children ill with bacillary dysentery who were treated with sulfanilylguanidine. They observed that the drug can be given in a dosage sufficient to insure saturation of the intestinal contents without producing more than a low concentration of the drug in the blood.

No toxic results were obtained in this group of children. However, the drug was not administered longer than fourteen days. Three of 25 adults receiving the drug for various conditions developed toxic reactions as follows: drug fever and unilateral conjunctivitis, a mild hemolytic anemia, and drug fever alone.

The authors recommended the following dosage in treating bacillary dysentery in children. Initial dose per os should be 0.10 gm. per kgm., and the maintenance dose 0.05 gm. per kgm. every four hours until the number of stools per day is four or less. Then, 0.10 gm. per kgm. should be given every eight hours for at least three days. They report that those children who were seen early and treated on or before the third day of the onset responded rapidly and very satisfactorily with a return to normal of the temperature, control of the diarrhea within three days, and a marked improvement in the general condition.

Some of the cases who were treated late in the disease showed the same striking improvement seen in the children treated early, but the majority ran a course uninfluenced by the administration of sulfanilylguanidine.

The writers conclude that the results are sufficiently encouraging to warrant further clinical trial of the drug. RULON W. RAWSON, M.D.

**Peterson, O. L., Strauss, E., Taylor, F. H. L., and Finland, M.: Absorption, Excretion, and Distribution of Sulfadiazine (2-Sulfanilamidopyrimidine).** *Am. J. M. Sc.*, 1941, 201: 357.

The absorption, excretion, and distribution of standard 5 gm. doses of sulfadiazine, the pyrimidine analogue of sulfapyridine and sulfathiazole, is presented in this article. Maximum blood levels were attained immediately after the intravenous injections, in two to three hours after the subcutaneous doses, and from four to six hours after the oral ones. Maximum concentrations occurred soon after the maximum blood level in each instance. Rectal absorption was very poor, only 4 per cent of the administered drug being recovered from the urine and 50 per cent (unaltered) from the first stool thirty-six hours after administration.

On the whole, higher concentrations of sulfadiazine are reached and maintained longer in the blood, with single and repeated doses, as compared with the levels obtained by the use of other common sulfonamides given in similar doses. Small proportions of the total drug concentrations were found in the blood in conjugated form and 20 to 35 per cent of the drug was recovered from the urine in this form, but the acetylation level did not increase during the course of the injections, even with high dosage.

High levels were found in the spinal, pleural, and ascitic fluids, in the first of which two-thirds of the blood level was attained. In this respect sulfadiazine resembles sulfapyridine and sulfanilamide.

In the light of preliminary reports the toxic effects of sulfadiazine are notably absent while its efficacy appears to be on a par with sulfapyridine and sulfathiazole in the treatment of most conditions.

STANLEY ROBBINS, M.D.

**Bieter, R. N., Baker, A. B., Beaton, J. G., Shaffer, J. M., and Others: Nervous Injury Produced by Sulfanilamide and Some of Its Derivatives in the Chicken.** *J. Am. M. Ass.*, 1941, 116: 2231.

The order of the drugs in the sulfanilamide series studied according to the amount of injury they pro-

duce in the nervous system of the chicken, beginning with the least injurious, is sulfanilamide, sulfapyridine, sulfathiazole, sulfamethylthiazole, sulfanilyl dimethyl-sulfanilamide, and sulfaphenylthiazole. Under certain conditions unknown at present, and after repeated doses, some cumulation of at least four of these drugs tends to occur in the sciatic nerve.

It is to be emphasized that observations on the damage to nervous tissue produced by the various drugs of the sulfanilamide series studied in the chicken are not to be transferred directly to man. It should be emphasized that the chicken appears to be much more sensitive to the toxic effects of these drugs on the nervous system than is man. Furthermore, differences in species of animals have been noted. Undoubtedly a similar type of injury, though much milder, can occur in man. The data in the literature seem to indicate that the frequency of peripheral neuritis in man places these drugs in a more or less systematic order similar to the classification determined by experiments in the chicken.

It is not yet possible to state that any of the six drugs herein described which have been used clinically should not be used in man. There may be possible obscure contraindications, as yet unknown, for all of them. However, the question of the routine use of one or more of those producing the most serious injury is as yet practically answered in the negative. No one knows why these toxic nervous reactions occur, whether a hypersensitivity on the part of the patient is the chief predisposing factor, or whether other factors are chiefly important. The tendency of certain of these drugs, at least, to accumulate in the peripheral nerves compared with what occurs in the brain and spinal cord seems to speak against a simple hypersensitivity. Rather, it appears as direct evidence in favor of the idea of specificity of the drugs for peripheral nervous tissue, which can be correlated with the clinical and pathological changes.

The explanation of the difference in degree of injury done by the drugs appears most logically to lie in their different chemical structures. It appears that these toxic manifestations are chronic. For this reason, when any of the drugs of the sulfanilamide group are used, physicians should observe their patients most carefully and institute every precaution to prevent any unnecessary rise in the concentration of the drug in the blood stream and any unnecessary prolonged use of the drug. In no instance should any of these drugs be used promiscuously or without careful supervision. CHARLES BARON, M.D.

## DUCTLESS GLANDS

**Gaebler, O. H., and Galbraith, H. W.: Effects of Preparations from the Anterior Pituitary Lobe in Experimental Pancreatic Diabetes.** *Endocrinology*, 1941, 28: 171.

The authors report observations of increased water intake and weight, nitrogen storage, and increase in blood, fat, and a very slight glycosuria in normal bitches which received single large injections of anterior pituitary lobe extracts.

The increase in weight and the nitrogen storage could be imitated by the addition of 100 gm. of sucrose to the standard diets.

Depancreatized animals which were well fed and received insulin, when given the same pituitary extract, had a lipemia, ketonuria, hyperglycemia, increased glycosuria, and some loss of nitrogen. On a high protein, low carbohydrate diet, the glycosuria was greater than could be accounted for by glycogen.

The authors concluded that the increased glycosuria was caused by interference with the utilization of glucose formed from protein.

One thyroidectomized, pancreatectomized animal stored nitrogen when the pituitary preparation was given with an increased insulin dose. The increased insulin did not prevent the increased glycosuria.

RULON W. RAWSON, M.D.

**Swingle, W. W., Remington, J. W., Hays, H. W., and Collings, W. D.: The Effectiveness of Priming Doses of Desoxycorticosterone Acetate in Protecting the Adrenalectomized Dog Against Water Intoxication.** *Endocrinology*, 1941, 28: 531.

Experimental water intoxication has often been described. Fatal intoxication in the normal animal is difficult to produce. It takes large amounts of fluid over a long period of time, and recovery is the rule if water is withdrawn when severe symptoms develop. In the adrenalectomized animal, however, it takes a small quantity of water and spontaneous recovery never occurs. The animal can be saved only by the intravenous injection of a large amount of cortical extract or hypertonic salt. If the adrenalectomized animal is previously primed with cortical extract it responds in every respect to water as does the normal animal. In the present experiments the ability of the synthetic steroid, desoxycorticosterone acetate, to replace cortical extract in its protective action against water is tested.

In these experiments dogs were used, and the "priming" dose of cortical extract was 3 c.cm. per kgm. body weight intravenously given just before the experiment; the dose of desoxycorticosterone acetate (D.C.A.) was 3 intramuscular injections of 5 or 10 mgm. given eighteen, twelve, and two hours before the experiment. Water was given hourly by a stomach sound. All regurgitated water was replaced.

It was found that in the normal dog convulsions occurred when the intracellular hydration reached 121 per cent. In the untreated, adrenalectomized dogs they occurred when it reached only 115 per cent. Also less than one-third as much urine was excreted in these dogs as in the normals. This shows that two factors contribute to this susceptibility of the adrenalectomized animal, a kidney factor and a "sensitivity to hydration" factor. It was found that priming with either cortical extract or desoxycorticosterone acetate restored both deficiencies to normal and protected against water intoxication. Poor-

er results were obtained from desoxycorticosterone acetate dissolved in an aqueous medium than when it was dissolved in oil. RICHARD WARREN, M.D.

**Kup, J. von: Concerning the Mechanism of the Anti-Gonadotropic Epiphyseal Factor** (Ueber den Angriffspunkt der antigonadotropen Epiphysenwirkung). *Frankfurt. Ztschr. f. Path.*, 1940, 54: 396.

After pituitary destruction in young animals sexual maturity and the sexual impulse fail; in both young and older animals, follicle ripening, and semen formation fail, while androsterone and folliculin are secreted in only small amounts. Young animals endure a removal of the hypophysis better than the older ones. The thyroid gland, after hypophyseal destruction, becomes atrophic, whereupon it is noteworthy that in spite of this a colloid inspissation with distention of the follicle of the thyroid results. The author points to 1 case which showed that the almost complete destruction of the glandular portion of the hypophysis is not fatal in human beings if it occurs in the adolescent. Also, in man, the existence of the sexual impulse is chiefly dependent upon the presence of the glandular portion of the hypophysis, even though the unequivocal presence of the sexual impulse is also closely bound up with the procreation of the sex hormone. Disturbances of the normal sexual impulse in the sense of an abnormal pattern can be brought about through changes in the chemical processes of the suprarenal cortex. The mechanism of action of the glandular portion of the hypophysis is twofold; a central, situated above the midbrain, and a glandular. To be sure, the normal glandular effect is subordinated to the central which originated from the brain. The hyperlibido observed after the removal of the genital gland is central, and cerebral in nature and can, by means of administration of epiphyseal extract, be entirely nullified.

Engel reported in the last few years on a few investigations by which the anti-gonadotropic effect of the epiphyseal extract could be measured. He had also worked out a procedure on which his investigations were founded. These test procedures are based on the fact that the glandular hypophyseal factor originating in the ovaries is nullified through the administration of the epiphyseal extract. These investigations by Engel appear, therefore, to indicate that the effect of the epiphyseal extract results not from central but from glandular paths. Engel's results have already been disproved by several authors. Engel has, however, refuted their claims in his new work and strongly defended the validity of his results. Serving to exaggerate the confusion, a few authors confirmed precisely each portion of the researches of Engel relating to the mentioned Engel test.

On the basis of researches painstakingly presented, it appears completely well founded, according to von Kup, that these epiphyseal factors which have been employed up to the present possess no noteworthy anti-gonadotropic factor which could be proved on the basis of the Engel test. The Engel test procedure is based on an error and the result of the test, often positive, was absolutely invalidated in the case of the 700 gm. growing young rabbits. Von Kup could show in his investigations with great certainty that presently employed epiphyseal factors possess no glandular anti-gonadotropic effect. The great number of results obtained with the epiphyseal factor in human beings with hypersexualism, as well as the personal observations of Kup, undoubtedly indicate that the effect depends not upon a glandular but on cerebral, that is, a central path, and, more precisely, through the central diminution of the sexual urge. Accordingly, the original theory of Hofstaetter can now be looked upon as acknowledgedly proved and substantiated.

In a few experimental animals, through the epiphyseal factor, the gonadotropic effect could be averted, or better, prevented from appearing; in these cases either illness of the animals or other constitutional states might have been the factor whereby they, as well as numerous controls, might have built up sufficient tolerance against the doses of gonadotropic hormones. The interpretation of these cases in the sense of an anti-gonadotropic epiphyseal factor is unconditionally erroneous. By means of the epiphyseal factor ("Epiphysan" according to Engel) the gonadotropic factor in rabbits cannot be increased. Through earlier researches on tuberculosis patients von Kup has demonstrated that the hypersexual state is not directly dependent on the tuberculous state but exacted through the present endocrine system, in which, in the hypersexual state, the abatement of the actively functioning pineal-body cells of the epiphyseal parenchyma and the decrease in weight of the entire organ could be proved in nearly every case. Teratomas and the gliomas lead most frequently, through destruction of the epiphyseal parenchyma, to sexual precocity when the closure of the epiphysis is attained before the twelfth year of life, but in the case of so-called pinealomas no precocity is encountered. It is irrefutable that the pathological picture of the precocity can also be evoked at the floor of the third ventricle, since the epiphysis is also bound up with the central nuclei; today this fact is generally accepted in regard to the glandular portion of the pituitary. The pineal body also exercises a definite internal secretion effect.

(SUNDER-PLASSMANN). H. HOFFMAN GROSKLOSS, M.D.

**Bischoff, F., Long, M. L., Rupp, J. J., and Clarke, G. J.: Endocrine Factors Influencing Tumor Development.** *Endocrinology*, 1941, 28: 769.

In this paper are recorded the following: (a) determination of the minimum dose of exogenous theelin which produces enhanced carcinogenesis; (b) the influence of prolan given before sexual development; (c) the influence of massive doses of prolan; (d) the influence of pregnant mare's serum; (e) the influence of the pituitary gonadotropic hormone administered

to produce maximum ovarian stimulation; and (f) the influence of the pituitary gonadotropic hormone administered to produce the antagonist effect.

The results of the experiments may be summarized as follows:

The parenteral administration of prolan, equine gonadotropine, or pituitary gonadotropic preparations produce acinar development of the mammary gland in the young (two months old) marsh-buffalo mouse comparable to that found at the age of one year. Exogenous theelin even in sublethal doses fails to produce this effect.

Sublethal doses of theelin (3.8 mgm. per mouse in five months) are required to enhance carcinogenesis in the marsh-buffalo virgin female mouse. The increase obtained for both the adenocarcinoma of the breast and for lymphosarcoma was only doubtfully significant.

Prolan failed to influence the onset of the adenocarcinoma of the breast or lymphosarcoma in virgin females when first administered before sexual maturity (720 units per mouse in twelve months), when given at the age of from sixty to ninety days (660 units per mouse in nine months), or when given in massive doses (2,700 units per mouse in nine months).

Pregnant mare's serum (750 units per mouse in eleven months) and purified pregnant mare's serum hormone (950 units per mouse in fourteen months) significantly retarded the onset and decreased the incidence of adenocarcinoma in the virgin female mouse.

Mice which had received the intermittent doses of prolan, mare's serum preparations, and pituitary gonadotropic preparations were able to become pregnant after one year of treatment.

Marsh-buffalo mice are susceptible to cancer and resistant to theelin when compared with other cancer-susceptible strains of mice.

The following theory is offered to explain the facts observed in the foregoing experiments:

In the marsh-buffalo strain the breasts of virgins remain undeveloped (scattered ducts and buds) during early adult life, but the repeated stimulation by the ovarian secretions finally produces a certain degree of acinar development. Up to this point there is no carcinogenesis. Further stimulation, however, carries the anatomical development to a point where the mutation leading to carcinogenesis (a hereditary factor) occurs. This further stimulation occurs because of the failure of the marsh-buffalo mouse to produce in later life proper defense mechanism against the repeated stimulation occurring with the recurring ovarian cycles, or because the character of the ovarian secretion changes. If this further stimulation were not due to failure of a defense mechanism or a change in the secretion at middle age then carcinogenesis should occur earlier in the prolan-treated mouse, which has acinar development six months or more before its normal control and still does not develop carcinoma faster than its control. Mare's-serum-hormone and pituitary-hormone-stimulation prolong the defense mechanism, possibly by the production of antihormones or by maintaining the early ovarian secretion. Massive doses of theelin (sublethal) are required to break down this defense mechanism which functions during early middle life.

JOSEPH K. NARAT, M.D.